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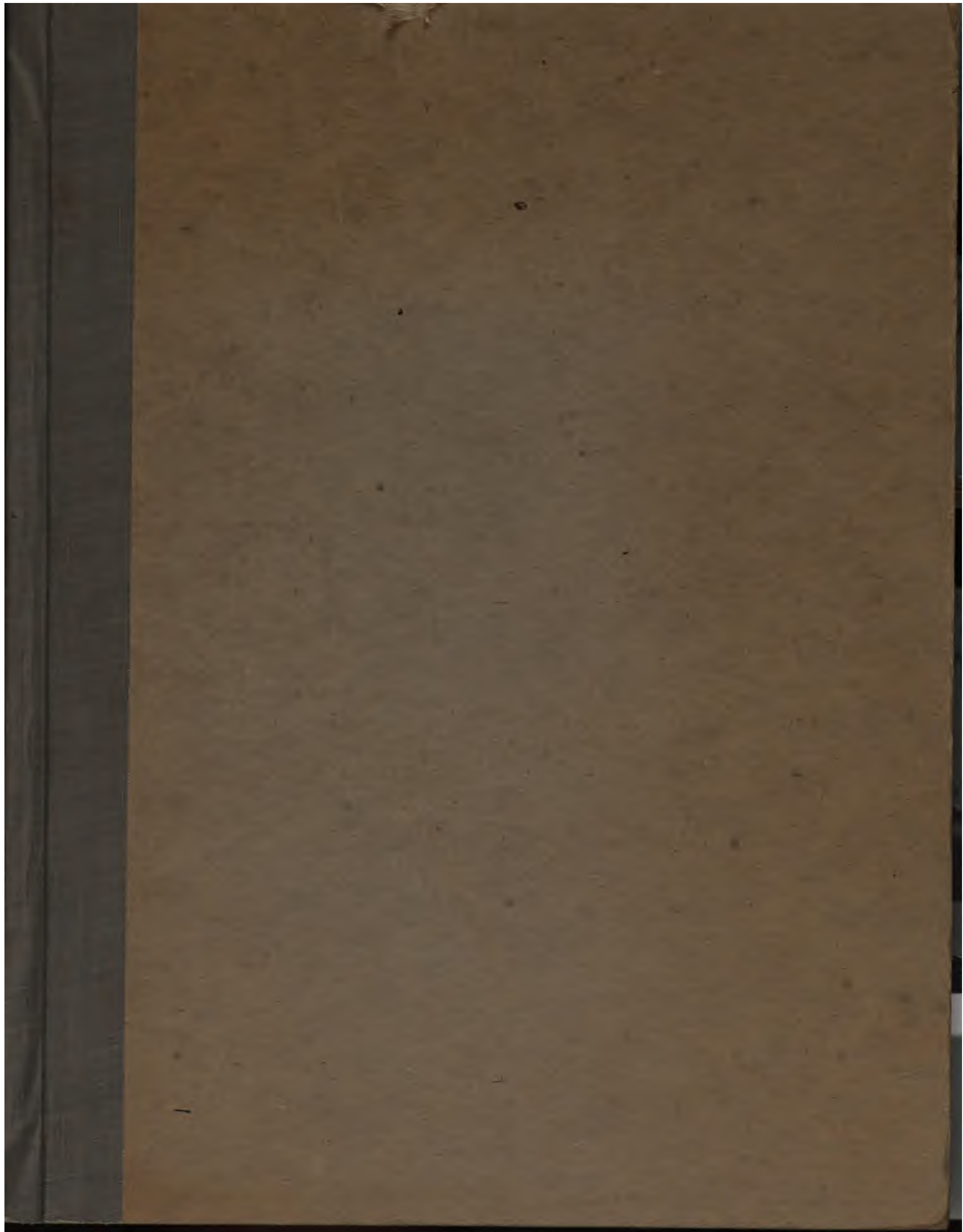
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Reports of
The Princeton University Expeditions
to Patagonia, 1896-1899

EDITED BY

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VOLUME IV—PALÆONTOLOGY

PART I—THE MARINE CRETACEOUS INVERTEBRATES

BY

T. W. STANTON

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(PAGES 1-43, PLATES I-X)

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WASHINGTON, D. C., Jan. 14, 1901.

Prof. W. B. SCOTT,
Princeton University,
Princeton, N. J.

Dear Sir :

I have the honor to transmit herewith for publication a brief paper on "the marine cretaceous invertebrates obtained by the Princeton expedition to Patagonia in 1899."

The collection was with your permission delivered to me for study by Mr. J. B. Hatcher in October, 1899, and its examination and description have continued at intervals since that time as official and other duties permitted. The fossils proved to be unusually interesting from the fact that they represent a facies of the Cretaceous fauna not hitherto described from South America. There are about 40 species of Mollusca in the collection, of which 31 are sufficiently well represented to be named and described. These indicate the Lower Cretaceous age of the beds from which they were derived.

Very respectfully,

T. W. STANTON.

Princeton Library

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THE MARINE CRETACEOUS INVERTEBRATES.

BY

T. W. STANTON.

THE fossils discussed in the following pages were collected in March, 1899, by Mr. J. B. Hatcher, in charge of the Princeton Expedition to Patagonia, and it is through his kindness and the generous courtesy of Prof. W. B. Scott that I have had the privilege of studying the collection, which, though not large, has proved very interesting.

In a paper entitled "Sedimentary rocks of southern Patagonia," Mr. Hatcher¹ has described the section from which the fossils were obtained, and named the various Cretaceous horizons recognized. The entire collection came from two localities, only a few miles apart, in the neighborhood of Lake Pueyrrydon, south latitude 47° 30', west longitude 72°. One of the localities is four miles east of Lake Pueyrrydon, near the mouth of the cañon of Rio Tarde, a small stream emptying into the east end of the lake. The other locality is about ten miles east of the same lake, and about two miles south of the western border of White Lake.²

The following description of part of Mr. Hatcher's section along the Rio Tarde is condensed from his account and gives only the features essential to the present discussion. The series about 750 to 800 feet in thickness that includes all the fossiliferous Cretaceous horizons is called the Pueyrrydon series. In it four formations are recognized, in ascending order as follows :

1. The *Gio beds*, consisting of 100 feet of soft green sands or marls with several harder, brown layers, each about two feet thick and full of the large *Ostrea tardensis*, with occasional specimens of a *Lithophagus*, form the lowest horizon exposed.

¹ *Am. Jour. Sci.*, 4th Ser., Vol. IX., pp. 85-108, Feb., 1900, with a map of southern Patagonia.

² These geographic features are all shown on the map accompanying the paper just cited. In the descriptions of species the locality labels accompanying the fossils are copied.

2. The *Lower conglomerate*, 20 feet in thickness, yielded occasional pieces of petrified wood filled with boring Mollusks (*Turnus dubius*).¹

3. The *Belgrano beds*, conformably overlying the lower conglomerate, consist of 300 feet of soft greenish sandstones and clays replaced toward the top by several layers of harder sandstones and impure limestones. These beds, especially in the upper portion, are rich in Cretaceous invertebrates and at the two localities have yielded all the species described in this paper except those just mentioned. The list of species will be given later.

4. The *Upper conglomerates*, forming the highest member of the Pueyrrydon series, consist of 330 feet of hard, fine-grained, red and variegated sandstone with occasional layers of clay, ending above in a series of very hard fine conglomerates, which have not yielded any identifiable fossils.

Resting unconformably on the upper conglomerates are the *Variegated sandstones*, 1350 feet in thickness, referred to the upper Cretaceous on stratigraphic grounds. Overlying these is a very thick series of Tertiary beds characterized by both vertebrate and invertebrate fossils.

From this brief description it is seen that all the Cretaceous fossils under discussion came from the lower 420 feet of the Pueyrrydon series, and a very large proportion of the species were collected from the upper part of the Belgrano beds about the middle of that series. All the specimens from the Gio beds and the lower conglomerate were obtained at the locality near the mouth of the cañon of Rio Tarde. The Belgrano beds at the same locality yielded the following species :

Lima sp.,	Solecurtus (?) limatus,
Pecten (Camptonectes) pueyrrydonensis,	Pleuromya latisulcata,
Pecten argentinus,	Corbula crassatelloides,
Pecten octoplicatus,	Martesia argentinensis,
Avicula (Oxytoma) tardensis,	Pleurotomaria tardensis,
Gervillia hatcheri,	Lunatia pueyrrydonensis,
Mytilus (?) argentinus,	Aporrhais (?) sp.,
Leda (?) corbuliformis,	Hatchericeras patagonense,
	Hatchericeras argentinense,

¹The specimens of *Tubulostium pupoides* have the same field label as this species but Mr. Hatcher states that the lower conglomerate yielded no other fossils except the wood with boring Mollusks and it is almost certain that the *Tubulostium* came from either the Gio beds or the Belgrano beds, as the appearance of the specimens would indicate.

Trigonia subventricosa,	Hatchericeras (?) tardense,
Astarte peralta,	Hatchericeras (?) pueyrrydonense.
Astarte postsulcata,	

Nine of these species together with a number of additional ones were obtained at the other locality in the Belgrano beds ten miles east of Lake Peuyrrydon. It is evident from an examination of the fossils that the collections from these two localities supplement each other and are from practically the same horizon as Mr. Hatcher determined in the field. The list of species from the second locality is as follows :

Pecten (Camptonectes) pueyrry-	Tellina sp.,
donensis,	Solecurtus (?) limatus,
Pecten argentinus,	Mactra (?) sp.,
Pecten octoplicatus,	Corbula crassatelloides,
Mytilus (?) argentinus,	Dentalium (Laevidentalium) lima-
Pinna sp.,	tum,
Nucula pueyrrydonensis,	Vanikoro (?) sp.,
Trigonia subventricosa,	Lunatia constricta,
Trigonia heterosculpta,	Aporrhais patagonica,
Trigonia, sp.,	Cinulia australis,
Astarte postsulcata (?),	Tornatellæa patagonica,
Tapes (?) patagonica,	Hatchericeras argentinense.
Tapes (?) sp.,	

Combining the collections from both localities, the Belgrano beds have yielded 36 species of invertebrates that are more or less fully described in the following pages, besides several additional forms represented by material too scanty and imperfect for generic identification.

Although the specific names in the above lists are all new, the assemblage of genera at once proclaims their Mesozoic character, and the appended excellent illustrations, drawn by Dr. J. C. McConnell, give abundant proof of their Cretaceous age.

The exact position of the beds yielding them in the Cretaceous system, as developed in Europe and other parts of the world, is more difficult to determine, because the evidence is incomplete and somewhat conflicting. Perhaps the first question to suggest itself is whether more than one great subdivision of the Cretaceous is represented in the three fossiliferous

horizons that Mr. Hatcher has recognized in the Pueyrrydon series. The fact that the species found in each of the three horizons appear to be peculiar to it would indicate different epochs if each horizon yielded enough species to constitute a real fauna. But the Gio beds yielded only a single species of *Ostrea* which is occasionally bored by a *Lithophagus* and the lower conglomerate contained only the small *Turnus dubius* boring in fossil wood. These are all forms that would not seem out of place if immediately associated with the fauna of the overlying Belgrano beds and probably do not differ greatly from it in age, the vertical distribution of species in this part of the section being due rather to local conditions than to great faunal changes. This conclusion is in harmony with Mr. Hatcher's observation that the beds are conformable.

In attempting to correlate this series with horizons that have been established elsewhere the natural course is to begin comparisons with formations described in adjacent regions, or at least on the same continent, but the data for direct comparisons are almost wholly lacking. It will, doubtless, be a surprise to the reader, as it was to the writer, to find that no previously described species is recognized in this collection from southwestern Patagonia. This is the more surprising for the reason that the Cretaceous is known to be widely distributed and represented by many horizons in South America. It covers considerable areas in Brazil where it has yielded a large fauna described by White¹ but the facies is entirely different from that of the Cretaceous of Patagonia, if indeed, the same horizons are represented. Along the western Cordillera, both Upper and Lower Cretaceous fossils have been described or reported from many areas extending from Venezuela and Colombia to the Strait of Magellan and as Mr. Hatcher's localities are in this western belt, it was naturally expected that many of the species would be referable to described forms. A careful examination of the literature describing South American Mesozoic fossils failed to reveal a single species with which any of the fossils here described can be positively identified. It should be remembered in this connection, however, that none of the collections previously described was obtained within several hundred miles of Lake Pueyrrydon, and that, with few exceptions, the collections were small and not really representative of the faunas. In a few cases species that I

¹Contributions to the Paleontology of Brazil. Archivos do Museu Nacional do Rio Janeiro, Vol. VII, 1887.

have described as new may be represented in previous South American collections by forms referred to or compared with European species. Besides searching for similar species in the American Cretaceous faunas, comparisons with the Old World faunas have been as careful and complete as the facilities and time at my command would allow, and in many instances related species have been cited, but I do not consider it wise to identify a form with a species described from a region thousands of miles distant, unless the agreement is so complete as to leave no room for doubt as to their identity. Examples of such species that may possibly have been thus cited under other names in previous papers are the *Ostrea*, some of the Ammonites, *Trigonia subventricosa*, and the *Tubulostium*, all of which will be further discussed.

In recent reviews of the geology and palæontology of the Argentine Republic by Valentin¹ and Ameghino the data for Mesozoic invertebrates are derived almost exclusively from the observations of Steinmann² in southern Patagonia and the work of Behrendsen³ on the collections of Bodenbender from the western Cordillera between 35° and 40° south latitude.

In the neighborhood of Port Famine and the Brunswick peninsula Steinmann recognized the Lower Cretaceous, from which Darwin and others had obtained a few fossils, to which he added an *Inoceramus* compared with *I. concentricus*. Two degrees north (about latitude 51°) he found well-preserved examples of an ammonite of the late Cretaceous group of "Haploceraten," which was thought to be identical with an Indian species, and with it Ananchytes, Gastropods and fossil wood. Still farther north between Lake Argentina (near latitude 50°) and Lake Rica the Cretaceous was reported to have more sandstones and more frequent fossils, including *Inoceramus labiatus* and *I. brongniarti*, or related forms. "From these finds [he states] it is evident that the clay shale system of the eastern slope of the Cordillera, whose thickness may be estimated at not less than 1,000 meters and which forms a broad zone from the Strait of Magellan to the lakes of Santa Cruz (perhaps to the latitude of Valdivia [40°]) belongs to the older and later Cretaceous."

¹ Segundo censo de la Republica Argentina, tomo I, pp. 63-255, Buenos Aires, 1898.

² Reisenotizen aus Patagonien, Neues Jahrb. f. Min., 1883, Bd. II, pp. 255, 256.

³ Zur Geologie des Ostabhanges der Argentinischen Cordillere. Zeitschr. d. Deutsch. Geol. Gesellsch. Bd. 43, pp. 369-420; Bd. 44, pp. 1-42, 1891-1892.

It seems probable that Steinmann's clay-shale system includes the Pueyrrydon series, but of the few fossils that he cites not one is represented in Mr. Hatcher's collection by similar species, nor even by the same genus, unless it is the ammonite, which is not cited with sufficient definiteness to permit comparisons.

The collections studied by Behrendsen came from a region 500 to 800 miles north of Lake Pueyrrydon. From them he determined the presence of several Jurassic and Cretaceous horizons, including Lias, Lower Oolite, Tithonian, Neocomian, Aptian (Gault), and Upper Cretaceous. The small number of species cited from some of the localities and horizons, however, must have made part of these determinations doubtful.

At one locality on the Arroyo Pequenco, between Rio Salado and Rio Malargue, strata referred to the Upper Neocomian yielded only *Exogyra couloni*, fragmentary remains of a Crustacean, a poorly preserved *Trigonia* that is compared with *T. aliformis*, a *Rhynchonella*, and *Mytilus curvieri*. The fact that some of the European forms referred to *E. couloni* differ so much from the typical form that they may be compared with *Ostrea tardensis*, suggested that the latter may be the form referred to *E. couloni* by Behrendsen, but his description and the figures to which he especially refers for comparison indicate a very different form. A poorly preserved specimen of *Trigonia subventricosa* might also reasonably be compared with *T. aliformis*. There is a possibility therefore that the Pequenco horizon may be the same as a part of the Pueyrrydon series.

The Aptian or Gault of Behrendsen's paper is represented by a few fossils from "Portezuelo de Carqueque," some distance north of the last mentioned locality. The only forms listed from this horizon are *Ammonites* sp., *Ostrea* sp., *Pecten* sp., and *Serpula phillipsi* Roemer, the last named species evidently being the basis of the determination of the age of the bed. The *Ostrea* is a mere unidentifiable fragment and the descriptive notes on the *Ammonites* and the *Pecten* make it certain that they can not be identical with any of the Pueyrrydon species. *Serpula phillipsi*, however, as described and figured from the Gault of England and Germany has considerable resemblance to the form I have described as *Tubulostium pupoides*, though for reasons pointed out in the description of the latter species it is not considered identical nor even congeneric. It is mentioned here merely as an example of possible identity that may some time be established by comparison of specimens from the two re-

gions. Even if the Pueyrrydon species should prove to be identical with the form from Portezuelo, which according to Behrendsen shows no essential difference from the European species, I should not consider that in itself sufficient proof of the Gault age of the beds containing it.

One other of Behrendsen's horizons, "the Neocomian of the Arroyo Triuguico and of Quili Malal," affords a slight basis of comparison. Two of the Ammonites, *Hoplites desori* and *H. neumayri*, are somewhat suggestive of two of the forms I have described as species of *Hatchericeras* and they are referred to, or compared with some of the same European species mentioned in my descriptions. It is evident, however, that none of the forms figured by Behrendsen is identical with or very closely related to any of the Pueyrrydon ammonites. Several other genera are represented in both this Neocomian and the Pueyrrydon fauna but the species are not identical.

Comparisons made with Cretaceous fossils described from other regions along the Andes from Chili northward gave similar negative results, and there are no indications of close relationship with North American Cretaceous faunas that are worthy of mention.

The very close resemblance of one of the Pueyrrydon species of *Trigonia* to *T. ventricosa* Krauss from the Uitenhage beds of South Africa led to a close examination of the fauna of that formation, and while another of its species, *T. van*, proved to be related to a Pueyrrydon form, and there are superficial resemblances in the species of *Gervillia*, *Astarte* and *Ostrea*, the fauna as a whole is too different to permit definite correlation. The Uitenhage beds are now generally referred to the Lower Cretaceous, though they were formerly assigned to the Jurassic.

As it is impossible to correlate the Pueyrrydon series by means of identical species, it is necessary to rely on more general comparisons, attempting to give due weight to the somewhat conflicting evidence.

Ammonites and Trigonias are usually among the most trustworthy groups in determining the age of beds. In this case it has been thought necessary to refer all the species of ammonites to a new genus whose relationships are not very firmly established, but nearly all the species with which these forms are compared occur in the Lower Cretaceous, and assuming that the genus is derived from *Hoplites*, or its near relatives, the stage of development observed is what one would expect to find at that period. Certainly no such forms are known later than the middle of the Cretaceous.

Trigonia subventricosa belongs to a purely Cretaceous section which has similar forms in the Upper Cretaceous, but the most closely related form is *T. ventricosa* from the Lower Cretaceous Uitenhage beds, which also yield a form similar to the other Pueyrriodon species *T. heterosculpta*, though another species which may belong to the same section occurs in the Upper Cretaceous Quiriquina beds of Chili. The evidence of both Ammonites and Trigonias, therefore, seems to favor the Lower Cretaceous age of the series.

The specific characters of some of the other groups, such as the Ostrea, the Gervillia, the Astarte species, the Pleuromya, and the Solecurtus (?) also tend to place the beds below the middle of the Cretaceous. Certain of the other forms, such as Cinulia, Tornatellæa, Lunatia, Martesia, Turnus, Mactra (?), and Pinna, have a more modern aspect and would not be out of place in an Upper Cretaceous fauna, while the remainder are mostly of types that have a greater range within the Mesozoic.

After my preliminary examination of this collection the opinion was expressed¹ that the horizon represented is "about the middle of the Cretaceous, at least not lower than the Gault." This judgment was influenced to some extent by the supposed occurrence in the collection of the characteristic Upper Cretaceous genus Pugnellus. Further study of the material after it was better cleaned showed that this generic identification was incorrect, and the closer examination of the collection has in several cases tended to emphasize the evidence for older rather than newer Cretaceous age. The former opinion is, therefore, now modified to this extent, that the horizon is not *later* than the Gault. Although the evidence as above sketched and as given more in detail in the specific descriptions does not seem to me to justify the definite reference of the Pueyrriodon series to any one of the European Cretaceous horizons it is reasonably certain that it belongs within the Lower Cretaceous and is not younger than the Gault.

¹ Quoted by Hatcher, Am. Jour. Sci., 4th Ser., Vol. IX, p. 90, and published in abstract of communication to Geological Soc. of Washington, Science, N. S., Vol. XI, p. 349, 1900.

PELECYPODA.

OSTREA TARDENSIS sp. nov.

Pl. I, Figs. 1 and 2, and Pl. II, Figs. 1 and 2.

Shell large, massive, subtriangular, or more or less crescentic in outline; lower valve very thick and very convex, obscurely carinate, with the beak more or less twisted laterally, but not distinctly coiled, the lower third of the valve also laterally curved, so as to give the shell its crescentic shape; upper valve thinner, flat or somewhat concave, with the beak more nearly straight and the other end curved to fit the lower valve; surface of both valves with rather coarse concentric lamellæ or imbrications, though on most of the specimens in the collection these are obscured by weathering. Some individuals also show obscure radiating plications. The pit or groove for the ligament is very large and broad and only slightly curved in both valves.

An average specimen measures 150 mm. from beak to base and 90 mm. in greatest breadth at right angles to that line. Convexity of the two valves 53 mm.

The eight specimens in the collection show some variations in form and proportion, but not more than species of *Ostrea* usually show. The curved form gives it the appearance of an *Exogyra*, but the beaks, especially of the upper valve, lack the spiral form characteristic of *Exogyra*.

The fact that *Exogyra couloui* Defrance has been reported from several localities in South America led to the comparison of that species with our Patagonian form. While it is true that some extreme varieties that have been figured as belonging to that very variable European Lower Cretaceous species somewhat resemble the Patagonian shell in form and general appearance, it does not seem to me that they can be identical. *O. tardensis* is certainly not at all like the typical and ordinary forms of *E. couloui*. Behrendsen¹ reports the occurrence of *E. couloui* at "Arroyo Pequenco between Rio Salado and Rio Malargue, not far from the Villa Beltran," Argentine Republic, and states that it is present in almost all the forms represented by d'Orbigny and Pictet, but agreeing especially with the figures given by Bayle and Coquand² of specimens from Chili.

¹ Zeitschr. Deutsche Geol. Gesellsch., Bd. 43, p. 419, 1896.

² Mém. Soc. Géol. de France, 2d Ser., t. IV, p. 37, pl. 7, figs. 1 and 2, 1851.

These Chilean specimens are distinctly exogyrate and have very little resemblance to the Patagonian form. In a later work by Coquand¹ they are referred to *Ostrea aquila*, which is also made to include *Exogyra imbricata* Krauss, a similar form from the Uitenhage beds of South Africa.

A species that resembles *O. tardensis* more closely than those above mentioned has been described by Stoliczka² under the name *Gryphæa ariana* from the Arrialoor group of the Indian Cretaceous. Judging from the figures the principal difference is in the somewhat less strongly curved form of *G. ariana*.

It is possible, though I think not probable, that the Patagonian *Ostrea* here described as new is specifically identical with some of the South American forms that have been referred to *Exogyra couloni*, but even if that should prove to be true, the identification of that species is believed to be erroneous in those cases and a new name is necessary.

Locality and position.—Mouth of cañon of Rio Tarde, four miles east of Lake Pueyrrydon, from a horizon (Gio beds) 400 feet below the Ammonite layer.

LIMA sp.

Shell small, ovate, slightly oblique, convex with prominent beaks and small inconspicuous ears; surface marked by about 15 rather prominent radiating ribs about equal in width to the interspaces, each of which bears a fine line. The anterior and posterior portions of the shell not covered by the ribs also bear a number of fine radiating lines and show irregular lines of growth.

The three imperfect specimens in the collection are probably immature, the largest measuring only seven millimeters in length and five millimeters in breadth.

Locality and position.—From the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon.

PECTEN (CAMPTONECTES) PUEYRRYDONENSIS sp. nov.

Pl. IV, Fig. 1.

Shell of medium size, ovate or subcircular in outline, moderately convex; right valve with unequal ears, the anterior one much larger, trian-

¹ Monographie du Genre *Ostrea*, p. 158.

² Cretaceous Fauna of S. India, vol. 3, p. 465, pl. 43, figs. 2, 2*, pl. 44, figs. 1-3.

gular with rounded extremity and bounded below by a deep byssal sinus, posterior ear much smaller, with the outer margin oblique and broadly rounded above, both with radiating striæ; the body of the shell marked by rather conspicuous irregularly spaced concentric lines and by very fine curved radiating impressed lines.

Height, 25 mm.; length of hinge line 11 mm.; greatest length (about the middle of the valve) 23 mm.

This description is drawn from the type, a well preserved right valve, from the locality ten miles east of Lake Pueyrredon. The collection from four miles east of the same lake contains some less perfect specimens believed to belong to this species, and among them are two left valves having the same sculpture and general form as the type. These are slightly more convex than the right valve and the anterior ear is similar in form and only slightly larger than the posterior.

The species has the typical *Camptonectes* sculpture and form as seen in a number of described Jurassic and Cretaceous species, but according to Dall¹ *Camptonectes* is not of generic or even subgeneric rank but should be placed as a section under *Pseudamusium*.

Locality and position.—From the Ammonite (Belgrano) beds at the two localities above mentioned.

PECTEN ARGENTINUS sp. nov.

Pl. IV, Fig. 5.

Shell of moderate size, ovate in outline, very gently convex, with median pointed beaks; ears subequal, in the form of slender right-angled triangles, projecting beyond the beak at their outer angle, separated from the body of the shell by impressed lines that form a right angle where they intersect at the beak; basal margin forming almost a semi-circular curve; surface smooth and polished, with very fine lines of growth, occasional more prominent impressed concentric lines, and very faint indications of fine radiating lines.

The figured specimen, which is of average size, is 23 mm. in height and 21 mm. in greatest length. The corresponding dimensions of the largest example in the collection are about twice as great. The convexity of single valves is not more than two to three millimeters.

¹Trans. Wagner Free Institute, Vol. III, pt. IV, p. 697, Philadelphia, 1898.

The type is apparently a left valve and the right valve is probably very similar with subequal ears and without a byssal notch, since there are about twenty such valves in the collection, and there are no others of different form that could be right valves of this species. The form is like that of the group for which Meek proposed the name *Entolium*, but it lacks the diverging "teeth" characteristic of that subgenus. Similar forms are not uncommon in the Jurassic and Cretaceous, such as *Pecten operculiformis* Gabb from the Lower Cretaceous Horsetown beds of California, which, however, has broader ears and no radiating striæ.

Locality and position.—From the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon, and ten miles east of the lake. The figured specimen is from the latter locality.

PECTEN OCTOPLICATUS sp. nov.

Pl. IV, Figs. 2 and 3.

Shell small, ovately subtriangular, conspicuously inequivalve, with eight strong radiating ribs on each valve. Right valve very convex, with prominent narrowed beak; anterior ear elongate-triangular, with a deep byssal notch beneath it; posterior ear much smaller and inconspicuous; ribs very prominent, about as broad as the interspaces, subangular, each bearing several obscure radiating lines and crossed by numerous fine concentric lines. Left valve much less convex, with subequal, rather broad triangular ears; ribs more rounded, much less elevated and relatively more narrow; the radiating and concentric lines also less conspicuous than on the right valve.

Height of an average specimen from beak to base 9 mm.; greatest length at right angles to above measurement 8 mm.; convexity of right valve about 4 mm., of left valve about 2 mm.

Locality and position.—Abundant in the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon and represented by three left valves apparently belonging to the species from the same horizon, ten miles east of the lake.

AVICULA (OXYTOMA) TARDENSIS sp. nov.

Pl. IV, Figs. 6 and 7.

Shell small, obliquely ovate, inequivalve; length of hinge line not quite equal to height of shell; beaks rather prominent, extending beyond the

hinge line. Left valve convex; anterior ear rounded, inconspicuous; posterior ear broad, flattened and more or less mucronately produced at the extremity, though this is not preserved on most of the specimens; surface of the whole valve, except the ears, with 25 to 30 fine radiating ribs, which tend to vary in size on the posterior portion. Right valve considerably less convex, with a deep byssal sinus under the anterior ear; posterior ear broad and flattened; surface marked by much finer and more numerous radiating lines than those on the left valve.

An average specimen measures 11 mm. in height and about the same in greatest length, which is below the middle of the valve. The convexity of the two valves united is about 5 or 6 mm.

The species is similar in form and sculpture to *A. nebrascana* Evans and Shumard, as figured by Meek,¹ from the Fort Pierre formation of the western United States. The subgenus *Oxytoma* ranges throughout the Mesozoic and is by some authors referred to *Pseudomonotis* instead of *Avicula*.

Locality and position.—Abundant in the Ammonite (Belgrano) beds at mouth of cañon of Rio Tarde four miles east of Lake Pueyrrydon.

GERVILLIA HATCHERI sp. nov.

Pl. III, Figs. 1 and 2.

Shell very large, slender, obliquely produced, rather convex, with very thick test; beaks terminal, pointed, not conspicuous; ventral margin nearly straight from the beaks for about one-third the length of the shell, then broadly convex to the rounded posterior end; dorsal margin slightly concave from the hinge to the posterior end of the shell; posterior wing not preserved on the type but evidently narrow; hinge area almost parallel with the longer axis of the shell, broad with seven or eight large transverse pits or grooves for the ligament, and three or four obscure, obliquely elongated teeth; surface marked only by lines of growth.

Length 260 mm.; greatest breadth (at the beginning of the posterior third of the shell) 64 mm.; greatest convexity of single valve about 28 mm., and thickness of test in anterior portion about the same.

The only specimen in the collection is the left valve figured, which is in an excellent state of preservation, except that nearly all the posterior wing

¹ U. S. Geol. Surv. Terr., Vol. IX, p. 34, pl. 16, figs. 3a, 3b.

is broken off and some of the hard, sandy matrix still clings to a part of the surface.

The species may be compared with *G. alpina* Pictet and Roux,¹ which is almost as large and somewhat similar in form, but is a straighter shell and has a more distinct anterior wing. *Gervillia dentata* Krauss² from the Uitenhage beds of South Africa is another large species that has some general resemblance to this form, but it is not so thick shelled, the beak is not so pointed and the shell is straighter.

Locality and position.—From the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon.

MYTILUS (?) ARGENTINUS sp. nov.

Pl. IV, Fig. 4.

Shell small, elongate-ovate, moderately convex; beaks prominent, slightly incurved; dorsal margin slightly convex without definite posterior angulation; ventral margin nearly straight, posterior end regularly and broadly rounded; surface marked only by very fine growth lines and concentric wrinkles, which are inconspicuous except when magnified.

Length of an average specimen from beak to base 8 mm.; greatest breadth 5.5 mm.; convexity of the two valves about 6 mm.

This little species has almost the form of a *Crenella*, and some obscure radiating lines on a weathered specimen increased the resemblance and led to its reference to that genus, when the collection was first examined. Well-preserved specimens, however, show no radiating sculpture.

Locality and position.—The figured type and four other specimens are from the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon, and one specimen from the same horizon ten miles east of the lake.

LITHOPHAGUS sp.

This genus is represented in the collection by a single small flask-shaped burrow in a fragment of oyster shell from the *Ostrea* horizon (Gio beds) 400 feet below the Ammonite layer at the mouth of the cañon four miles

¹ As figured by Pictet and Campiche, Terrain Crétacé de Sainte Croix, pl. 155, figs. 2-4. According to these authors the species includes the Cretaceous forms figured by Sowerby (Min. Conch., pl. 511) under the name *G. aviculoides* but not belonging to that Jurassic species.

² Nova Acta, Vol. 22, p. 458, pl. 50, figs. 1a-1c.

east of Lake Pueyrrydon. The burrow, which is filled with calcareous sand and probably still contains the shell, measures 10 mm. in length and 5 mm. in greatest diameter.

PINNA sp.

A single small Pinna in the collection is too imperfect for specific description. The shell is rather slender, moderately convex, not carinate, nor distinctly angular on the median line, with the upper two thirds of the shell marked by 10 or 12 radiating lines and the rest of the surface bearing irregular, less conspicuous lines of growth. The specimen, which is probably not a mature shell, measures 90 mm. in length, 28 mm. in greatest breadth and 10 mm. in convexity of both valves.

Compared with *P. robinaldina* d'Orbigny, which Behrendsen¹ has reported from the Lower Cretaceous of the Argentine Republic, this species may be easily distinguished by its more slender and less convex form and by the absence of a median angulation. It much more closely resembles the Upper Cretaceous *P. lakesi* White² from the Fort Pierre formation of Colorado.

Locality and position.—From the Ammonite (Belgrano) beds ten miles east of Lake Pueyrrydon.

NUCULA PUEYRRYDONENSIS sp. nov.

Pl. IV, Figs. 8 and 9.

Shell of medium size, elongate subovate, moderately convex; beaks nearly terminal at the posterior end, which is almost vertically truncate; dorsal margin slightly convex; anterior end broadly rounded, most prominent above, passing below into the convex ventral margin; surface nearly smooth, bearing very fine, closely arranged lines of growth, with a few more conspicuous concentric furrows at wide intervals.

Length 17 mm.; height 12 mm.; convexity of the single valve about 5 mm.

The species is quite similar in form and surface to *N. simplex* Deshayes, from the Neocomian of France, as figured by d'Orbigny,³ except that its anterior end is more broadly rounded.

¹ Zeitschr. Deutsche Geol. Gesellsch., Bd. 44, p. 25, 1892.

² 12th Ann. Rep. U. S. Geol. and Geog. Surv. Terr., pt. I, p. 17, pl. 11, fig. 1, 1880.

³ Paléont. Franç. Terr. Crét., t. III, pl. 301, figs. 11 and 12.

Locality and position.—From the Ammonite (Belgrano) beds ten miles east of Lake Pueyrrydon, represented by a left valve, an internal cast, and the imprint of the exterior of another one.

LEDA (?) CORBULIFORMIS sp. nov.

Pl. IV, Fig. 11.

Shell small, elongate-ovate, rather ventricose, with prominent, tumid submedian beaks; dorsal margin descending almost equally before and behind the beaks; anterior end broadly rounded; posterior end more narrow, subtruncate and very slightly upturned at the extremity; ventral margin gently convex; surface marked by relatively coarse, regular concentric lines.

The type measures 10 mm. in length, 7 mm. in height and 6 mm. in convexity of the two valves.

The description is drawn from a single specimen which retains most of the shell of the left valve and shows the internal cast of the right. Impressions of small nukuloid hinge teeth are faintly shown. The reference to Leda is based on the form of the shell and is somewhat doubtful.

Locality and position.—Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon.

TRIGONIA SUBVENTRICOSA sp. nov.

Pl. IV, Figs. 19 and 20.

Shell rather large, sublunate, inflated and broadly rounded in front, much contracted and considerably produced behind; beaks prominent, near the anterior end; ventral margin very convex and prominent in its middle third, where the strongest costæ terminate, in front passing imperceptibly into the anterior margin by a more gentle curve, and behind passing almost straight or with a slightly concave curve toward the posterior end; dorsal margin concave; area rather narrow, convex, divided above the middle by a narrow groove, with inconspicuous lines of growth, not bounded by distinct carinæ; escutcheon also nearly smooth, large, deeply excavated, bearing only faint costellæ, that near the front are very short, directed backward very obliquely from the area, while toward the posterior end they become somewhat larger, more nearly transverse, passing entirely across the escutcheon and sometimes curving forward near

the margin ; remainder of the shell bearing about 22 to 24 strong costæ, radiating from the margin of the area and divided into two rather distinct sets. The anterior 10 or 11 are very strong, distant, coarsely and irregularly tuberculate, curved forward near the margin of the shell, occupying the inflated anterior two thirds. Successive costæ become larger and more nearly straight, the 9th or 10th usually being the largest. The other costæ on the contracted posterior third of the shell are much finer, more closely arranged and nearly straight or slightly irregular and sinuous, without tubercles, and directed obliquely downward and backward. The surface also bears rather conspicuous, closely arranged lines of growth.

The figured type, which has lost a small portion of the posterior end, measures 73 mm. in length, 63 mm. in height, and about 57 mm. in convexity of the two valves. The corresponding dimensions of another specimen are 82 mm., 66 mm., and 60 mm., respectively. In each case the length is measured from the front margin to the posterior end, and the height somewhat obliquely from the beak to the most prominent part of the ventral margin.

This species belongs to the section *Scabræ*, which is characteristic of the Cretaceous, and it is somewhat closely related to *T. aliformis* Parkinson. The form which most closely resembles it, however, is *T. ventricosa* (Krauss),¹ from the Uitenhage beds of South Africa.

Comparisons have been made with some small specimens collected by Dr. Holub on Zwartkop river, as well as with the published figures, and while the general resemblance is very great, the Patagonian form differs in being somewhat longer and less inflated, and the tubercles on the anterior ribs are coarser, less regular and more distant. *T. tuberculifera* Stoliczka from the Upper Cretaceous Trichinopoly beds of southern India is also similar in general form and sculpture, but it is still shorter than *T. ventricosa* and the costæ on the posterior portion are coarser and not so numerous.

In beds referred to the Upper Neocomian at Arroyo Pequenco, Argentine Republic, several hundred miles north of these Patagonian localities, Dr. Bodenbender collected a *Trigonia*, listed by Behrendsen² as *Tri-*

¹ Nova Acta Acad. Caes. Leopold-Carolin. Nat. Cur., Vol. 22, p. 456, pl. 49, figs 2a-2d. Better figures have been published by Lycett in Brit. Foss. Trigoniæ, p. 119, and by Stoliczka in Cret. Fauna of S. India, vol. 3, pl. 15, figs. 9, 9a.

² Zeitschr. Deutsche Geol. Gesellsch., Bd. 43, 1891, p. 418.

gonia conf. *aliformis* Park., which may possibly be identical with our species, but the single specimen collected was too imperfect for full description. It was associated with an oyster identified with *Exogyra couloni* DeFr.

Locality and position.—Represented by 13 specimens from the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrredon and by four specimens from the same horizon ten miles east of the lake.

TRIGONIA HETEROSCULPTA sp. nov.

Pl. IV, Figs. 16–18.

Shell rather small, ovately trigonal, moderately convex; anterior end broadly rounded, rather prominent; ventral margin gently convex; posterior end slightly produced, narrowly rounded at the extremity and very obliquely subtruncate above; dorsal margin almost straight (very slightly concave) from the beak to the posterior end; beaks not very prominent, situated about one third the length of the shell from the anterior end; area and escutcheon narrow, not very sharply defined on the adult shell, both being destitute of sculpture other than rather prominent lines of growth and a broad furrow above the middle of the area. The sculpture of the young shell, as seen on the beaks and on small specimens, is entirely different from that of the adult, and the form also is different. In young shells, seven millimeters or less in length, the height and length are about equal and the sculpture consists of strong concentric ribs, parallel to the growth lines and about as prominent on the area as on the anterior portion of the shell. At this stage the area is bounded above and below by well-marked carinæ and the small escutcheon is smooth. As the shell grows, the next two or three ribs become swollen and bent downward a short distance in front of the area, then one or two form V-shaped angles there, and finally in the adult form of sculpture there are two distinct sets of costæ—one set consisting of slender, smooth costæ resembling those of the young shell, but ranging obliquely backward and downward from the front of the shell until they almost meet the other set, the number varying from 6 to 12 or more according to age; the posterior set consisting of fewer and larger, more nearly vertical, smooth costæ that range downward from the margin of the area to the ventral border.

The sculpture is thus seen to agree closely with that of the *Undulatæ* section of *Trigonia*, except that the area is not so well defined. The

largest specimen illustrated is so badly weathered that the anterior set of costæ has been almost obliterated, and the figure is therefore misleading in that respect. The other figures, though smaller, show the sculpture better.

The largest specimen in the collection (Pl. IV, Fig. 18) measures 51 mm. in length, 38 mm. in height and about 19 mm. in convexity of the single valves. The corresponding dimensions of another specimen are 29 mm., 22 mm. and about 9 mm., respectively.

The only American Cretaceous Trigonia that resembles this one in general appearance is *T. hanetiana* d'Orbigny,¹ from the Quiriquina beds of Chili, which may be easily distinguished by differences in the sculpture, the posterior set of costæ radiating from the beak instead of from the margin of the area, and tending to break up into large irregular tubercles toward the ventral margin. *T. van* Sharpe² from the Uitenhage beds of South Africa is more nearly related, as its sculpture is of the same type. It differs, however, in outline, the posterior end being more prolonged and broader, and the anterior ribs are more oblique, while the posterior set also have a different inclination. *T. robinaldina* d'Orbigny,³ a French Neocomian species, has somewhat similar sculpture but differs in outline and is more convex.

T. heterosculpta is not easily assigned to any of the described sections of Trigonia. The costæ are similar to those of the Undulatæ but the ill-defined area and escutcheon seem to prevent its reference to that group, which is said to be characteristic of the Jurassic.

Locality and position.—From the Ammonite (Belgrano) beds ten miles east of Lake Pueyrrydon, represented by about 20 valves.

TRIGONIA sp.

Associated with the preceding from the locality ten miles east of Lake Pueyrrydon, are two specimens evidently belonging to a distinct species of Trigonia, but too imperfect for specific description, as they do not show the character of the posterior end, area and escutcheon. The form is rather ventricose and short and the anterior portion of the shell bears nine

¹ Voyage dans l'Amerique Merid., t. III, pt. 4, p. 127, pl. 12, figs. 14-16. The species is also figured by Steinmann, Neues Jahrb. f. Min., etc., Beilageband X, p. 101, pl. 7, figs. 8, 9.

² Trans. Geol. Soc. Lond., 2d Ser., Vol. VII, p. 194, pl. 22, fig. 5.

³ Paléont. Franç. Terr. Crét., t. III, pl. 299, figs. 1, 2.

or ten large smooth ribs, that radiate from the beak and are broader than the interspaces.

ASTARTE PERALTA sp. nov.

Pl. V, Figs. 1 and 2.

Shell very large and massive, ovate, moderately convex, considerably higher than long, with prominent submedian beaks, from which the outline descends rapidly and almost equally, with a gentle convex curve behind, and concave in front to the extremity of the lunule, which is rather large and deeply excavated with abrupt walls; ventral margin regularly rounded; surface marked by fine lines of growth and by rather prominent concentric ridges, which are less prominent on the middle of the valve than toward the ends, and become broader and less conspicuous toward the ventral margin of the adult; hinge broad and massive, showing in the right valve a small anterior cardinal tooth, a very large middle cardinal, two large sockets for the reception of the cardinals of the left valve, and traces of anterior and posterior laterals; posterior cardinal not developed. The free border of the shell is not crenulated on the interior.

Height 125 mm., length 101 mm.; convexity of both valves about 80 mm.

This description is drawn from a well-preserved right valve showing all the essential specific and generic features, though a fragment has been broken from the posterior end. There is another imperfect specimen showing the beak of a left valve.

The species is distinguished by its large size and its great height, as compared with its length. In these features it recalls some of the gigantic species of *Astarte* from the Jurassic, such as *Astarte damesi* Boehm,¹ though differing from them in outline and other details.

The growth lines of *A. peralta* show that its height, as compared with the length, increases rapidly with age and these two dimensions are equal at least until they reach 25 mm. At that size the shell resembled *A. postsulcata*, except that the sculpture was considerably coarser and the anterior end was less prominent.

Locality and position.—From the (Belgrano) Ammonite beds at mouth of cañon four miles east of Lake Pueyrredon.

¹ Palaeontographica, Supplement II, Die Bivalven der Stramberger Schichten, p. 561, pl. 63, figs. 1-3.

ASTARTE POSTSULCATA sp. nov.

Pl. V, Figs. 3-7.

Shell of medium size, subcircular in outline, moderately convex, sub-equilateral, the anterior end of the shell being slightly more prominent than the posterior; beaks prominent, angular; lunule rather large, deeply excavated, with abrupt walls; surface marked by rather coarse lines of growth, by occasional more prominent concentric furrows and by a broad, shallow depression or furrow extending in a curve from the beak to the postero-ventral margin: hinge with two well-developed cardinal teeth in each valve, and both anterior and posterior laterals considerably developed. Margin of the shell not crenulate within.

An average specimen measures 25 mm. in height, 26 mm. in length and 18 mm. in convexity of the two valves. Shells of this size have comparatively thick massive shells, as shown in figures 5, 6 and 7, while other specimens only slightly smaller and agreeing in all other respects, have very much thinner shells. This comparative thinness of test is believed to be due to immaturity.

This species belongs to the same group as *A. peralta*, the young of which it evidently closely resembles, but it may be distinguished even from specimens of the same size by its much finer lines of growth, by the presence of the radiating posterior furrow, and by slight differences in outline, especially the greater prominence of the anterior end.

Locality and position.—Represented by over 20 specimens from the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrredon.

TAPES (?) PATAGONICA sp. nov.

Pl. IV, Figs. 12 and 13.

Shell small, rounded subquadrate, moderately convex; beaks prominent, situated on the anterior third of the shell; dorsal margin excavated in front of the beaks, gently convex behind them; anterior end broadly rounded, passing imperceptibly into the convex ventral margin; posterior end broad, obliquely subtruncate; surface marked by rather coarse, regular concentric lines and grooves, with occasional deeper furrows, the sculpture being strongest on the middle of the valve and fading out toward the ends. There is no distinct lunule and the narrow escutcheon is about half filled by the ligament.

Length of the type, 17 mm.; height, 15 mm.; convexity of the two valves, 8 mm.

Besides the well-preserved type, the species is represented by a cast of one valve and possibly by two other imperfect valves, that are referred with some doubt to the species. The hinge and other internal characters are unknown and the generic reference is, therefore, very uncertain.

Locality and position.—From the Ammonite (Belgrano) beds ten miles east of Lake Pueyrredon.

TAPES (?) sp.

Associated with the preceding species at the same place and horizon is another form of about the same size, but considerably more elongate, with the beaks nearer the anterior end, less convex and with smoother surface. The pallial sinus is deep, rather broad and horizontal. Represented by a nearly complete internal cast retaining small portions of the shell and by the imprint of a part of the surface of the same individual.

TELLINA sp.

A single small internal cast retaining small portions of the shell is referred to this genus on account of its form and general aspect. The valves are slightly twisted laterally; anterior end broadly rounded; posterior end obliquely subtruncate, much more narrow and somewhat shorter, than the front end; ventral margin slightly convex; beaks rather prominent; surface apparently smooth.

Length, 21 mm.; height, 13 mm.; convexity of the two valves, 5 mm.

Locality and position.—Ammonite (Belgrano) beds ten miles east of Lake Pueyrredon.

SOLECURTUS (?) LIMATUS sp. nov.

Pl. IV, Fig. 10.

Shell small, elongate oval, subequilateral, with very small, inconspicuous beaks; dorsal and ventral margins very slightly convex; anterior end regularly rounded; posterior end slightly contracted, broadly rounded into the ventral margin below, more abruptly rounded or subangular above; surface with a polished appearance but marked by numerous fine growth lines that vary somewhat in size.

Internal casts show imprints of two very small teeth and subequal

ovate adductor muscle impressions. The pallial line is very faint and the sinus not distinctly seen.

Length of an average specimen 20 mm.; height 9 mm.; convexity of both valves about 4 mm.

This species closely resembles *Solen æqualis* d'Orbigny¹ which the same author afterward referred to *Solecurtus*. It is smaller than that species and not quite so slender.

Locality and position.—The figured specimen is from the Ammonite (Belgrano) beds 10 miles east of Lake Pueyrrydon. It also occurs at the locality four miles east of the lake, and is represented by about a dozen specimens from the two places.

PLEUROMYA LATISULCATA sp. nov.

Pl. VI, Figs. 1 and 2.

Shell of medium size, oblong ovate, or subcuneate in form, the greatest convexity near the front end midway between the beak and the ventral margin; anterior end broadly rounded, posterior end more narrowly rounded and slightly gaping; ventral margin very slightly convex; dorsal margin descending abruptly in front of the beaks and rather rapidly behind them; beaks prominent, approximate, somewhat flattened, situated near the anterior end of the shell; a rather prominent broad ridge, on which the sculpture is most strongly marked, extending from the beak almost vertically to the antero-ventral angle, a much more obscure posterior umbonal ridge running obliquely to the posterior end, and the side between these two ridges flattened; surface marked by very prominent concentric ribs separated by broader furrows, and the whole covered with finer growth lines.

Length, 38 mm.; height, 25 mm.; convexity of the two valves, 20 mm.

Locality and position.—From the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon. Represented by a single specimen.

MACTRA (?) sp.

Shell rather small, elongate, moderately convex, with prominent beaks slightly in advance of the middle; anterior end broadly rounded; posterior end narrow, obliquely subtruncate; ventral margin gently convex: an

¹ Pal. Fr. Terr. Crét., t. 3, p. 321, pl. 350, figs. 5-7.

angular umbonal ridge extending near and almost parallel with the dorsal margin from the beak to the posterior end; surface marked by regular, comparatively rather coarse, concentric lines and furrows; hinge and other internal features unknown.

Length of the best preserved specimen 28 mm.; height 16 mm.; convexity of single valve about 5 mm. Another fragment indicates a specimen with corresponding measurements about one third greater.

The material is too imperfect and fragmentary for a satisfactory specific description or figure and as the hinge is unknown no definite generic reference can be made. The form, sculpture, and other features observed indicates that it belongs to the Mactridae though probably not to *Mactra* in the restricted sense as defined by Dall. It has a greater resemblance to *Spisula*.

Locality and position.—From the Ammonite (Belgrano) beds ten miles east of Lake Pueyrrydon.

CORBULA CRASSITELLOIDES sp. nov.

Pl. IV, Figs. 14 and 15.

Shell small, subtriangular, rather convex; beaks prominent, broad, situated slightly in advance of the middle; dorsal margin descending almost equally forward and backward from the beaks; ventral margin convex; anterior end broadly rounded; posterior end obliquely subtruncate; umbonal ridge distinct, angular, descending obliquely to the postero-ventral angle; surface marked by regular fine concentric lines.

Length of an average specimen, 5.5 mm.; height, 4 mm.; convexity of the two valves, 4 mm.

This abundant little species resembles *C. bodenbenderi* Behrendsen¹ from the Neocomian of Arroyo Triuguico, Argentine Republic. It is somewhat smaller than Behrendsen's species, more inequilateral, more convex, and the posterior end is relatively broader. In general form it resembles the young of some species of *Crassatella*.

Locality and position.—Represented by numerous specimens from the Ammonite (Belgrano) beds ten miles east of Lake Pueyrrydon and at mouth of cañon four miles east of the same lake.

¹ Zeitschr. deutsch. geol. Gesellschaft, Bd. 44, 1892, p. 19, pl. 3, figs. 6^a–6^d.

MARTESIA ARGENTINENSIS sp. nov.

Pl. VI, Figs. 3 and 4.

Shell small to medium in size, elongate ovate or cuneate, very inflated, with a spherical aspect from the front, regularly tapering to the posterior end, which gapes rather widely, anterior hiatus shield-shaped, closed by a callum; a single broad accessory umbonal valve present (form not accurately determined), other accessory valves unknown; surface marked by fine regular lines of growth, parallel with the margins of the shell, and by two faint umbonal furrows that diverge slightly in passing obliquely from the beaks to the ventral margin just behind its most prominent portion, and are more prominent on internal casts than on the shell itself; the burrows in fossil wood, in which the shells are found, not lined with a calcarous shell.

An average specimen measures 13 mm. in length; 7.5 mm. in height, and 8 mm. in greatest convexity.

The two umbonal furrows in this species suggest its reference to *Parapholas*, which is represented in the Cretaceous by somewhat similar forms, but that genus has paired umbonal valves, or a single one formed of two fused pieces.

Locality and position.—From the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrredon, represented by a dozen specimens, most of which are immature.

TURNUS DUBIUS sp. nov.

Pl. VI, Figs. 5-8.

Shell small, subglobose, or broadly ovate, gaping widely behind, and in front with a broad, shield-shaped hiatus, which in some specimens seems to be filled by a callum, its upper corners almost rectangular; beaks prominent, approximate, in front of the middle of the shell; dorsal margin nearly straight, posterior end and venter very broadly rounded; umbonal groove slightly oblique, narrow, inconspicuous, somewhat more prominent on internal casts than on the exterior, extending from the beak to the most prominent part of the ventral margin; surface also marked by very fine, closely arranged, regular lines of growth that cross the umbonal furrow obliquely and are sharply bent upward in front of it, parallel with the margin of the anterior gape.

The internal cast also shows a deep groove, corresponding to a heavy internal rib, extending back from the beak to the posterior margin above the umbonal ridge, and some specimens show a much fainter furrow in the same position on the exterior of the shell.

On one specimen near the beak there is a small subtriangular structure that appears to be an accessory valve (protoplax) and indicates by its form that there were two of them, as in *Xylophaga*.

The animal burrowed in wood, forming long more or less tortuous shelly tubes like those of *Teredo*, the surface of the tubes bearing irregular annular wrinkles, or lines of growth.

Length of a medium sized specimen, 7 mm.; height, 6.5 mm.; convexity of both valves, 6 mm. The larger tubes measure 7 mm. in diameter and some of them, though broken, are over 30 mm. long.

This species is quite similar in habit and general form to some species of *Teredo*, such as *T. torulosa* Stoliczka from the Cretaceous of southern India, but the apparent presence of a callum and of accessory valves and the strong internal rib prevent its reference to *Teredo*. In the presence of a callum closing the anterior hiatus, it differs also from the type of *Turnus*, but in other characters, including the supposed "protoplax," it agrees with that genus, for although described as without accessory valves, a specimen of the type species (*T. plenius*) from the Cretaceous of Cottonwood Creek, California, shows a structure precisely like that described as a probable protoplax in this species. The presence or absence of a callum in the adult is considered less important than the other features described.

Several fragments of fossil wood in the collection are filled with the tubes and these have yielded 19 more or less perfect specimens of the shells.

Locality and position.—From mouth of cañon of Rio Tarde, four miles east of Lake Pueyrredon, Lower conglomerate, 300 feet below Ammonite bed.

SCAPHOPODA.

DENTALIUM (LÆVIDENTALIUM) LIMATUM sp. nov.

Pl. VI, Fig. 9.

Shell rather large, slightly arcuate, with circular cross-section; surface appearing smooth and highly polished, but showing when magnified very

fine, closely arranged lines of growth that pass directly around the shell.

The figured specimen measures 55 mm. in length and 7 mm. in diameter at the larger end. The test itself rather thick and the surface is not well preserved on the specimen figured but another fragment shows it perfectly. None of the specimens are well enough preserved to show the apertures unbroken, and the subgeneric reference is therefore uncertain.

Locality and position.—From the Ammonite (Belgrano) beds ten miles east of Lake Pueyrredon, represented by four fragmentary specimens.

GASTROPODA.

PLEUROTOMARIA TARDENSIS sp. nov.

Pl. VII, Figs. 1 and 2.

Shell large, broadly conical, consisting of not more than seven or eight convex whorls; apical angle about 90° ; base broadly rounded, not umbilicated; slit rather broad (5 mm. in the type), extending back over about one-fifth of the last whorl, situated above its middle, so that the slit-band on the whorls of the spire is near the middle of their visible portion; aperture obliquely subovate; outer lip simple, acute; inner lip rounded below and forming a distinct callus above, which is especially prominent and thick over the umbilical region where it spreads out in a broadly crescentic form; surface marked by numerous inconspicuous spiral lines, by an obscure furrow a short distance below the smooth slit-band and another a little farther above it, and by rather coarse, irregular lines of growth.

The type measures 110 mm. in height (with apex of spire restored) and 127 mm. in greatest breadth.

The species is based on a single specimen, which, though lacking the apex of the spire and a part of the test, is otherwise in an excellent state of preservation. It probably should be referred to the section *Pero-trochus*, which Fischer established for *P. quoyana* Fischer and Bernardi and to which he provisionally referred a number of Jurassic species which have the same general features as this shell, though none of them is so stout in form. No Cretaceous species known to me is so closely related as to require detailed comparison.

The specific name is derived from the Rio Tarde, near which the fossil was found.

Locality and position.—From the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon.

TUBULOSTIUM PUPOIDES sp. nov.

Shell of medium size, dextral, subglobose, or very stout pupiform, with a very broad, rounded apex, umbilicated, with the umbilicus broader in the young than in the adult, when it is almost closed; whorls four or five, slightly flattened on the sides, convex above and below, the last one much contracted and produced in a short free tube near the circular aperture; surface marked by obscure irregular transverse wrinkles and by a small spiral furrow near the middle of the whorl. On the best preserved specimen the sutures are linear and inconspicuous, but two other specimens, believed to belong to the same species that have lost the outer layer of shell, show rounded whorls and deep sutures:

The type measures 10 mm. in height and 9 mm. in greatest breadth. The contracted aperture is 3 mm. in diameter.

This species was overlooked until after the drawings were all made and arranged in plates and for that reason a figure is not given. It is evidently congeneric with *Tubulostium callosum* Stoliczka,¹ from which it differs in its more nearly pupoid form, in its rounded base and in the absence of the "external callosity." Stoliczka refers the genus to the Vermetidæ. Somewhat similar forms have been described as Annelids, and one such, *Serpula phillipsi* Roemer, is mentioned by Behrendsen² as occurring in the Aptian of Portzuelo de Carqueque, Argentine Republic. In fact the determination of the Aptian or Gault at that place seems to be based on the presence of that species. As figured by Phillips³ under the name *Vermicularia sowerbii* it is somewhat larger than our species, its apex is more conical, the umbilicus is broader, and the last whorl is not narrowed and produced in a free tube. These differences are certainly sufficient to separate the Patagonian form from Roemer's species, and yet the general resemblance is close enough to suggest a possibility that Behrendsen may have had the Patagonian species. He states, however, that he had nu-

¹ Cretaceous Fauna of S. India, Gastropoda, p. 241, pl. 18, figs. 26-32.

² Zeitschr. Deutsch. Geol. Gesellsch., Bd. 43, p. 418, 1891.

³ Geology of Yorkshire, pl. 2, fig. 29.

merous well-preserved examples and he could find no essential difference between them and the European forms. Stoliczka refers *Serpula phillipsi* to Burtinella, a Gastropod genus related to Tubulostium.

Locality and position.—From mouth of cañon four miles east of Lake Pueyrrydon, 300 feet below the Ammonite beds, according to the labels. The material has more the appearance of specimens from the underlying Gio beds or the overlying Belgrano beds.

VANIKORO (?) sp.

A single, small, probably immature, specimen has the form and sculpture of this genus. The form is stout, consisting of three rapidly increasing whorls, with the surface marked by rather prominent transverse lines, or small costæ crossed by numerous much finer spiral lines; aperture broadly ovate; umbilicus rather narrow.

Height, 6 mm.; breadth, 5.5 mm.; height of aperture, 4 mm.; breadth of same, 3.5 mm.

Locality and position.—From the Ammonite (Belgrano) beds ten miles east of Lake Pueyrrydon.

LUNATIA CONSTRICTA sp. nov.

Pl. VI, Figs. 10 and 11.

Shell rather small, ovate, consisting of about four convex whorls that are slightly flattened or compressed on the upper third; suture deeply impressed; aperture ovate, broadly rounded below; inner lip forming a moderately heavy callus, reflected below, so as to partially cover the narrow umbilicus; surface marked by numerous coarse lines of growth and by sharply marked narrow constrictions, or furrows, of which there are four, parallel with the growth lines on the last whorl of the type.

Height of type specimen, 24 mm.; greatest breadth, 21 mm.; height of aperture, 19 mm.; breadth of same, 12 mm.

The species is represented by four fairly well-preserved specimens, the best of which is figured. Associated with these are about a dozen more imperfect specimens, some of which seem to have a smoother surface and less elevated form and may belong to a distinct species.

Locality and position.—From the Ammonite (Belgrano) beds, ten miles east of Lake Pueyrrydon.

LUNATIA PUEYRRYDONENSIS.

Pl. VI, Fig. 12.

Shell of moderate size, broadly subovate, consisting of about four rapidly increasing convex whorls; suture impressed, bordered by a narrow, flattened shoulder; aperture subovate, narrow above, broadly rounded below; callus of the inner lip rather narrow and thin, slightly reflected over the narrow umbilicus below; surface marked by numerous distinct, crowded lines of growth.

Height, 33 mm.; greatest breadth, 34 mm.; height of aperture, 28 mm.; breadth of same, 18 mm.

This species is easily distinguished from the preceding by its stouter form, shouldered whorls and different sculpture.

It is possible that these two species may prove to be synonyms of European forms, but in the absence of actual specimens for comparison I consider it safer to treat them as distinct species, rather than to attempt to identify such simple forms by descriptions and figures only, especially when the associated faunas are different.

Locality and position.—Represented by a single specimen from the Ammonite (Belgrano) beds at mouth of cañon four miles east of Lake Pueyrrydon.

APORRHAIS PROTUBERATUS sp. nov.

Pl. VI, Figs. 13-15.

Shell of medium size, rather stout, consisting of six or seven convex whorls, of which the last on approaching the aperture becomes carinate above the middle and flattened below, the carina extending in a curve to the upper extremity of the wing; aperture rather narrow and elongate; outer lip prolonged upward beyond the preceding whorl and produced in a broad, very thick, subquadrate wing, whose outer margin is broadly rounded below and extended above in a short blunt process; inner lip with a heavy callus that forms a subspherical protuberance just above the anterior canal and extends in a thinner deposit over a large part of the spire; anterior canal short, broad and nearly straight, with a slight notch or emargination at the extremity; posterior canal not distinctly developed, but apparently represented by the callus extending up the spire; surface

of the spire marked by numerous fine, thread-like, spiral lines, and by rather prominent, slightly curved transverse ribs, with a tendency to form blunt tubercles on the middle of the whorl, giving it a subangular appearance. The transverse ribs nearly or quite disappear from the back of the last whorl when it becomes carinate, and on the front aspect of the shell the sculpture is almost entirely concealed by the callus.

Height of the largest type specimen, with apex of spire restored, 27 mm.; greatest breadth, 21 mm.; breadth of last whorl, exclusive of wing, 11 mm.

In the general form of the aperture, the excessive thickening of the outer lip and the heavy deposits of callus, this little shell resembles some forms of *Pugnellus*, and in the preliminary examination of this collection it was referred to that genus. *Pugnellus manubriatus* Gabb,¹ on which the subgenus *Gymnarus* was based, especially resembles it in the form of the wing-like expansion of the outer lip and in the callus restricted to the front of the shell. On cleaning some specimens of the Patagonian species more thoroughly, however, it was found that the anterior canal is much shorter and straighter than in any species of *Pugnellus*, that it lacks the well-developed anterior notch or sinus and is not bent inward toward the aperture at the extremity, and the affinities of the species seem to be with *Aporrhaidæ* rather than *Strombidæ*. It is not a typical *Aporrhais*. It has many features in common with the recent *A. occidentalis* Beck, for which Gabb proposed the subgenus *Arrhoges*, though the heavy callus on the inner lip and spire and the greater development of an anterior canal prevent its reference to that subgenus. The peculiar rounded boss at the lower end of the callus is not duplicated in that position in any other *Aporrhaid* species known to me.

Locality and position.—Abundant in the Ammonite (Belgrano) beds, ten miles east of Lake Pueyrriodon. Represented in the collection by over 30 individuals, most of which are very imperfect.

APORRHAIIS (?) sp.

A larger species, apparently belonging to the *Aporrhaidæ*, is represented by a single specimen consisting of four whorls of the spire from the locality four miles east of Lake Pueyrriodon. The whorls are convex and each

¹ Palæont. of California, Vol. I, p. 125, pl. 29, fig. 229.

bears about fifteen prominent transverse costæ, crossed by numerous fine, thread-like, spiral lines. There is also a prominent spiral ridge, which is just covered by the succeeding whorl and below which the surface bears only the spiral lines. Species with similar form of whorl and sculpture are common in *Anchura*, *Aporrhais* and other genera of this family.

TORNATELLÆA PATAGONICA sp. nov.

Pl. VI, Figs. 18 and 19.

Shell of medium size, ovate, consisting of four or five rapidly increasing convex whorls, of which the last constitutes about five-sevenths of the total height; apex of spire obtuse, not prominent; aperture elongate, narrow above, rounded and apparently somewhat sinuous or emarginate below; outer lip slightly thickened and smooth within; inner lip forming a moderate callus and bearing two distinct folds, one of which is near the lower end and the other below the middle of the aperture; surface marked by rather coarse spiral furrows, of which there are about 25 on the last whorl.

Height of the larger specimen, 14 mm.; breadth, 10 mm.; height of aperture, 10 mm.; breadth of aperture, 4 mm.

The species is represented by only two specimens, both of which are figured. Similar forms have frequently been described as *Actæon* and *Solidula*, but according to Cossmann's¹ revised descriptions of those groups such forms should be referred to Conrad's genus *Tornatellæa*, which ranges from the lower Jura to the Miocene.

It should be stated, however, that the types of this species have the outer lip and lower part of the aperture broken and the generic reference is therefore not absolutely certain.

Locality and position.—From the Ammonite (Belgrano) beds, ten miles east of Lake Pueyrredon.

CINULIA AUSTRALIS sp. nov.

Pl. VI, Figs. 16 and 17.

Shell small, subglobose, consisting of about four convex whorls, of which the last forms three-fourths of the total height; suture slightly impressed; surface marked by numerous inconspicuous, impressed, spiral lines (about

¹ *Essais de Paléoconchologie comparée*, Liv. I, pp. 45–50, Paris, 1895.

30 on last whorl); aperture not perfectly preserved, but evidently entire and rounded below, with outer lip thickened and reflected, so as to form a smooth band two millimeters wide externally, and columella with two strong folds.

Height, 10 mm.; greatest breadth, 9 mm.; height of aperture, 7.5 mm.; breadth of aperture, 4 mm.

The type specimen is very well preserved, but the outer lip is broken, so that the form of the upper part of the aperture cannot be determined accurately, and it is not certain whether the inside of the outer lip is crenulated. There are two other imperfect specimens in the collection. Behrendsen¹ reports imperfectly preserved specimens of a *Cinulia* from the Neocomian at Arroyo Triuguico near its junction with the Rio Neuquen, but it is not possible to determine from his descriptive note whether they are identical with the present form or not.

Locality and position.—From the Ammonite (Belgrano) beds, ten miles east of Lake Pueyrredon.

CEPHALOPODA.

Genus HATCHERICERAS gen. nov.

Shells attaining a large size, compressed, involute (the umbilicus usually forming about one-fifth of the diameter of the shell), with rounded venter and very slightly convex sides, which in the adult may be nearly or quite smooth, but in the young are marked by low, curved, branching ribs that sometimes tend to form tubercles around the umbilical margin and on either side of the venter. In the early stages the ribs cross the venter but later they are interrupted more or less distinctly there before they disappear from the flanks. The relatively narrow umbilicus is funnel-shaped, its slopes becoming smooth and somewhat concave in the later stages but the inner whorls have rounded margins on which the ends of the ribs are seen within the umbilicus.

Lobes and saddles of the suture not very complex, nor deeply incised, and characterized generally by their great breadth. The ventral lobe with

¹ Zeitschr. deutsche geol. Gesellschaft, Bd. 44, 1892, p. 18.

its two robust branches on each side is almost as long as the first lateral lobe, which is irregularly tripartite and very broad at the base. The second lateral lobe is similar to the first, but very much smaller and more slender. There is only one well developed auxiliary lobe outside the umbilicus. (The details of the suture on the umbilical slopes have not been seen.) The siphonal saddle is oblong, rather broad, tripartite at the extremity and serrated on the sides in adult sutures. The other saddles are more or less distinctly bipartite but not symmetrically divided. The external and first lateral saddles have about the proportions of the first and second lateral lobes, respectively, and the second lateral saddle is relatively much broader and stouter than the first. The internal, or dorsal, portion of the suture has not been studied in the type species, but in *H. argentinense* the antisiphonal, or dorsal, lobe is slender, pointed and dentate and there are two rather simple, paired dorsal saddles of which the outer one is the broader.

The type is *Hatchericeras patagonense* sp. nov., described below.

The few ammonites collected by Mr. Hatcher in Patagonia have proved to be very interesting, and at the same time troublesome, in that they show features suggesting relationship with several described generic groups, while they do not possess all the essential characteristics of any one of them. It seems necessary, therefore, to state the facts, so far as they are determined, and to propose a new generic name for them. The forms thus grouped together, vary considerably in sculpture and general appearance, but in at least two of them, the type and *H. argentinense*, these differences are superficial only, and there is general agreement in all essential features. The other two forms, each represented by a single small specimen, are placed here with some doubt, for reasons that will be given in connection with the specific descriptions. In the generic comparisons that follow, the data for *Hatchericeras* are taken from *H. patagonense*, unless otherwise stated.

The adult in general form and surface has some resemblance to *Haploceras*, but the sutures are very different in all their details. In its smooth adult whorls, the amount of involution, the form of the umbilicus and, to a less extent, the character of the suture, it suggests *Ammonites cleon* d'Orbigny, which has been made the type of *Cleoniceras* by Parona and Bonarelli,¹ but is referred with the other members of the group to Desmo-

¹ Palæontographia Italica, Vol. II, 1896, p. 83.

ceras by Sarasin,¹ who has thoroughly studied them more recently. The entire absence of periodic constrictions, and the reduced number and different form of the auxiliary lobes, in the species now referred to Hatchericeras, prevent their reference to Desmoceras.

Another group that suggests comparison, both in general form and in sutures, is that typified by the South Indian *Ammonites telinga* Stoliczka, for which Kossmat² proposed the name Neoptychites, but this is somewhat more involute than Hatchericeras, the whorls are more inflated, the aperture is greatly contracted laterally, and the sutures show many differences in details, especially in the proportions of the dorsal and external saddles, and the first lateral lobe and the form and posture of the accessory lobes and saddles. It is true that no examples showing the complete aperture of Hatchericeras have been seen, but one showing a small part of the body chamber gives no evidence of lateral contraction.

The suture of *Ammonites leopoldinus* d'Orbigny, which is generally referred to Hoplites, closely resembles that of *H. patagonense* and the general form of the adult shell is somewhat similar, though the sides are less convex, the umbilicus is broader and has not the funnel shape characteristic of Hatchericeras. Young shells show much greater differences in both form and sculpture, *Amm. leopoldinus* having a row of distinct elongated tubercles on either side of the somewhat flattened venter, obscure ribs that are not developed on the middle of the flanks ending abruptly at these tubercles, and another row of tubercles around the umbilical margin. The young of our new genus, which have been studied only in *H. argentinense*, do not have the venter distinctly flattened, nor bordered by well-developed tubercles elongated parallel with the venter. As to the similarity of the sutures, Sarasin, in the paper above cited, has called attention to the fact that similar sutures, suggesting a transition to Placenticeras, are developed in both Hoplites and Desmoceras, and that such resemblances in sutures do not necessarily mean generic identity. In this connection mention should be made of the striking general resemblance in the sutures of the Patagonian Ammonite and those of *Amm. clypeiformis* d'Orbigny, which is referred by most authors to

¹ Quelques considérations sur les genres Hoplites, Sonneratia, Desmoceras et Puzosia. Bull. Soc. Géol. de France, 3d Sér., Vol. XXV, 1897, pp. 760-799.

² Untersuchungen über die südindische Kreideformation, Beiträge zur Paläont. und Geol. Österreich-Ungarns und des Orients, Bd. IX, p. 165, Wien, 1895.

Placenticeras, but is regarded by Kossmat as representing a distinct group related to his *Neptychites* and also showing some affiliation with *Hoplites leopoldinus*. But, although there is also similarity in the amount of involution and in the form of the umbilicus, the differences in the general form of the shells, especially in the ventral region, and in the details of the sutures, show that the species referred to *Hatchericeras* are not congeneric with *Amm. clypeiformis*. The conclusion drawn from all these comparisons is that the Patagonian ammonites described herein have an assemblage of characters not found in any described group, and they are therefore assigned to a new genus, whose affinities are closest with the *Hoplitidæ*, though Hyatt's¹ definition of that restricted family is hardly broad enough to include it.

HATCHERICERAS PATAGONENSE sp. nov.

Pl. VIII, Figs. 1 and 2, Pl. IX, Fig. 1.

Shell large, involute, compressed, with very slightly convex sides that show an obscure flattening between the middle of the whorl and the umbilicus; venter regularly rounded; umbilicus about one fifth the diameter of the shell, funnelform, the shoulder broadly rounded and the umbilical wall of each whorl slightly impressed or concave in the middle; surface of adult whorls marked only by rather coarse irregular growth lines that are seen when the shell itself is preserved but leave no trace on the internal cast. These growth lines show slightly in the umbilicus and are most conspicuous on the middle of the flank, where they form rather coarse, slightly curved wrinkles that may indicate the position of a lateral ear or lappet, such as are frequently seen in *Hoplites* and other groups of ammonites. The figured type gives no indication of the sculpture of the young, as its umbilicus could be cleaned only enough to show about one and a half whorls, but the smaller specimen, showing about three whorls in the umbilicus, bears on the umbilical margin of the inner whorl the ends of rather distant prominent ribs (or a row of elongated tubercles) closely resembling those seen in the umbilicus of *H. tardense*.

The suture has been sufficiently characterized in the generic description and is figured natural size on plate IX. The other figures of the type specimen are one half natural size.

¹ In Zittel's Text-book of Palæontology, Vol. I, pt. II, p. 584, Macmillan & Co., 1900.

There are only three specimens belonging to the species in the collection and they agree very closely except in size and state of preservation. Of the dimensions given below those under I belong to the figured type.

	I	II	III
Diameter	250 mm.	210 mm.	300 mm.
Umbilicus	53	45	± 62
Height of aperture	148	113	± 175
Breadth of aperture	72	63	94

The comparisons with described species have already been suggested in the discussion of the genus. It seems remarkable that no young specimens of the species were collected and every small ammonite in the collection has been critically examined in the hope of finding the sculptured young of this form. The only one that at all suggests such an immature stage is the specimen described beyond as *H. tardense*, which shows similar sculpture in the umbilicus and even at the diameter of 74 mm. begins to show the disappearance of the ribs, especially on the venter and the umbilical wall, but the umbilicus is relatively broader and the sculpture seems too pronounced to permit its reference to this species.

Locality and position.—"Mouth of cañon four miles east of Lake Pueyr-rydon; Ammonite (Belgrano) beds."

HATCHERICERAS ARGENTINENSE sp. nov.

Pl. IX, Figs. 2-5.

Shell of about the same form and proportions as *H. patagonense* but probably not attaining so great a size, the flattened band between the umbilicus and the middle of the whorl somewhat more distinct than in that species; venter regularly rounded, and smooth on mature whorls; umbilicus funnelform, nearly one-fourth the diameter of the shell, with rather narrowly rounded or subangular shoulder and smooth walls on adult whorls, but showing distinct, closely arranged ribs in the earlier stages; surface marked by rather prominent, closely arranged ribs, part of which begin in the umbilicus of young shells up to a diameter of 50 mm., but on later whorls originate on the umbilical shoulder, cross the sides in a gentle sigmoid curve and become swollen but not distinctly tuberculate near the rounded venter, where they are interrupted by a smooth band,

except on young specimens of 8 to 10 mm. or less, when they continue across the venter; ribs in part simple, part branching once just before reaching the middle of the flank and part consisting of short ribs on the outer half of the whorl interpolated between the long ones.

Sutures having the same general characteristics as in the preceding species, with broad, not very deeply dissected, lobes and saddles. The forms and proportions of the several lobes and saddles are nearly the same in the two species, the principal difference being in the more complicated and deeper dissection of the suture in *H. patagonense*, but this difference is not as great as a comparison of the figures would indicate, because both the sutures of *H. argentinense* are taken from much smaller and less mature specimens than that of the other species, and the larger one is considerably weathered. There is only one auxiliary lobe visible on the flank, and the dorsal portion of the suture, as seen on a specimen about 20 mm. in diameter, shows a slender, pointed and dentate, antisi-phonal lobe and two rather simple, paired dorsal saddles on either side.

Some variations in sculpture at different stages of growth have already been indicated and, as the sculpture shows a decided tendency to become less prominent on the larger specimens which are septate throughout, it is possible that the last whorls of fully adult specimens become smooth as in *H. patagonense*.

Young shells also differ greatly in form from the adult, the umbilicus being relatively larger (that is the shell less involute) and the whorls much more convex, so that in shells 10 mm. or less in diameter the breadth of the aperture is nearly or quite equal to the height, but these proportions change rapidly to those of the adult. The following measurements of four specimens indicate the normal proportions of the species and the change from youth to maturity. The measurements under I are from the largest specimen in the collection, which was too badly weathered for figuring; those under II and III from the specimens represented by figures 4 and 5 on plate IX; and those under IV from the inner whorls of a specimen that was broken down for the study of the early stages.

	I	II	III	IV
Diameter	128	122	48	10
Umbilicus	28	25	11.5	3
Height of aperture	68	65	23	4.8
Breadth of aperture	37	35	14	4.2

The close agreement in the sutures and in general form and proportion of the shell indicates rather near relationship with *Hatchericeras patagonense*, while the more pronounced and more persistent sculpture of this form serves to distinguish it specifically. Even if additional collections should prove that large old specimens become smooth, such specimens can be at once distinguished from *H. patagonense* by the finer, more closely arranged ribs on the earlier whorls, as shown in the umbilicus.

This species, especially in its immature stages, has many features in common with *Hoplites* and should probably be included in that genus as broadly defined in Zittel's *Handbuch* to include several diverse groups, but these resemblances are believed to indicate family relationship and the probable immediate ancestry of the new genus here proposed.

Localities and position.—One specimen (the largest collected) with the preceding species from the "mouth of cañon, four miles east of Lake Pueyrredon" and about twelve more or less fragmentary specimens, mostly young, from "ten miles east of Lake Pueyrredon," all from the Ammonite (Belgrano) beds.

HATCHERICERAS? TARDENSE sp. nov.

Pl. X, Figs. 3-5.

Shell rather small, compressed, moderately involute, the umbilicus measuring about one fourth the diameter of the shell; sides of the whorls slightly convex, venter regularly rounded, becoming smooth on mature whorls; surface marked by rather prominent and distant, slightly sinuous ribs, that mostly spring in twos and threes from well-marked tubercles on the rounded umbilical shoulder, with occasionally one or two shorter interpolated ribs between the groups of longer ones; ribs more prominent on the earlier whorls, where they cross the venter without interruption and tend to form tubercles on either side of it. The outer half of the last whorl of the type specimen shows a gradual weakening of the ribs and tubercles, the sculpture disappearing entirely from the venter and the umbilical slope near the aperture.

The suture drawn from the middle of the last volution is of the same type as in the two preceding species but somewhat less complex in its details, probably on account of immaturity of the specimen, which is small and septate throughout. (In the figure the inner part of the suture beyond the

second lateral lobe is out of its normal position, on account of the fact that the draughtsman accidentally passed from the suture he was drawing to the succeeding one at that point.) The single type specimen measures 75 mm. in diameter; umbilicus, 19 mm.; height of aperture, 36 mm.; breadth of aperture, 22 mm.

The species is doubtfully referred to *Hatchericeras* on account of the general agreement in form and suture with the type of the genus, and the belief that the young of the type species may have had similar sculpture, as indicated by the fact that the tubercles or ends of ribs visible in the umbilicus of *H. patagonense* are very similar in appearance to the umbilical tubercles on the earlier whorls of the present form. The type of sculpture does not differ greatly from that of *H. argentinense* and the changes in the different stages of growth are in the same directions. The relative size of the umbilicus seems too large and the sculpture too pronounced to permit the identification of this specimen as a young individual of *H. patagonense*.

Like the preceding species, this form could probably be referred to *Hoplites*, in the broad sense in which that term has generally been used. It has some superficial resemblance to *H. desori* Pictet and Campiche, which Behrendsen has reported from the lower Cretaceous of the Argentine Republic, but it is more involute than that species, has a more rounded venter, the ribs are relatively coarser and more distant and the umbilical tubercles are not so pronounced.

Locality and position.—From the Ammonite (Belgrano) beds at mouth of cañon, four miles east of Lake Pueyrriydon.

HATCHERICERAS? PUEYRRYDONENSE sp. nov.

Pl. X, Figs. 1 and 2.

Shell small, of the general aspect of *H. tardense*, but more involute, the umbilicus measuring not quite one fifth the diameter of the shell; venter rounded, but showing a tendency to be flattened in earlier stages; umbilicus with subangular shoulder bearing incipient tubercles that are visible on the inner whorls, the umbilical slope of the last whorl steep and smooth; surface marked by prominent, slightly sinuous ribs that branch near the middle of the flank and usually either branch again, or have interpolated between adjacent pairs a shorter branching rib, so that

the number is about four times as great at the periphery as on the umbilical shoulder; ribs swollen on each side of the venter, which they cross without interruption in the early stages, but on part of the last whorl of the type specimen they broaden and become less conspicuous; surface also marked by numerous growth lines that curve strongly forward on the middle of the whorls; suture not visible.

Diameter, 53 mm.; umbilicus, 10 mm.; height of aperture, 28 mm.; breadth of aperture, 16 mm.

The species is based on a single small specimen which is evidently related to *H. tardense*, but easily separable from it by its more involute form and the differences in the sculpture.

Locality and position.—Ammonite (Belgrano) beds at mouth of cañon, four miles east of Lake Pueyrredon.

STANTON : THE MARINE CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE I.

	PAGE
OSTREA TARDENSIS Stanton	11
Fig. 1. Lower valve of an average specimen. Natural size.	
Fig. 2. Opposite view showing upper valve of same individual.	



M^cConnell del.

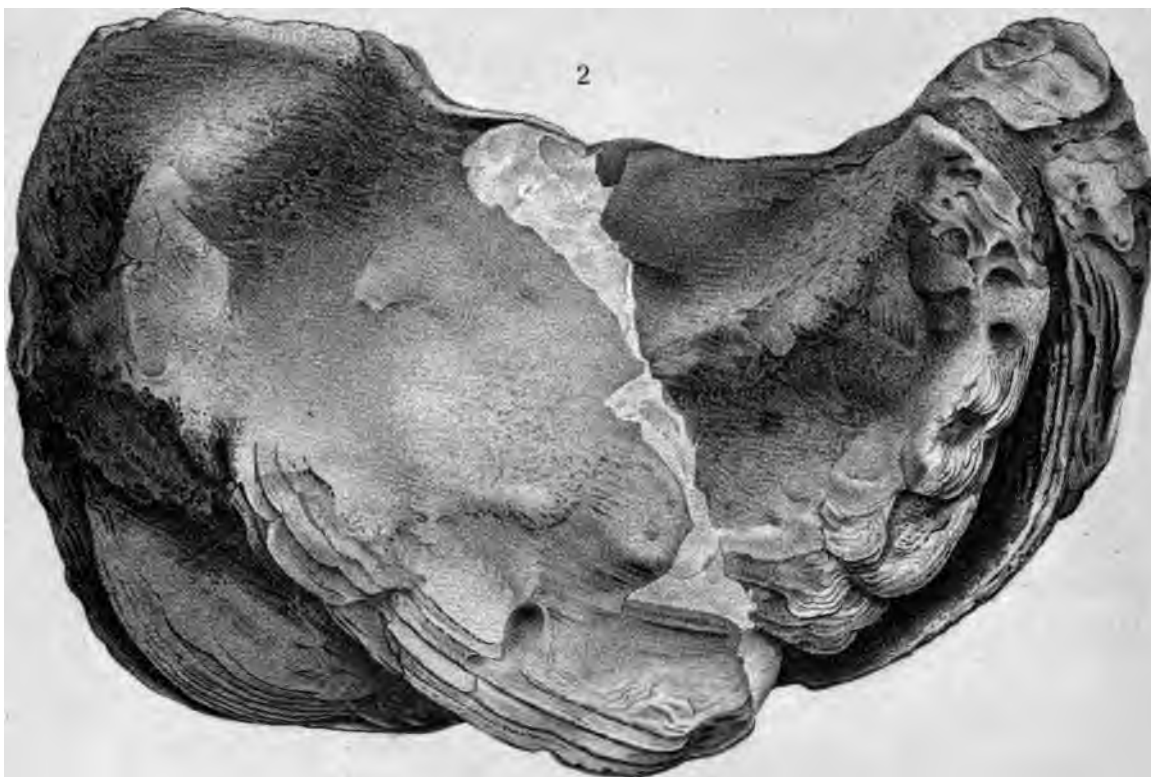
Werner & Winter, Frankfurt 9M., lith.

CRETACEOUS INVERTEBRATES.

STANTON: THE MARINE CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE I.

OSTREA TARDENSIS Stanton	PAGE II
Fig. 1. Lower valve of an average specimen. Natural size.	
Fig. 2. Opposite view showing upper valve of same individual.	



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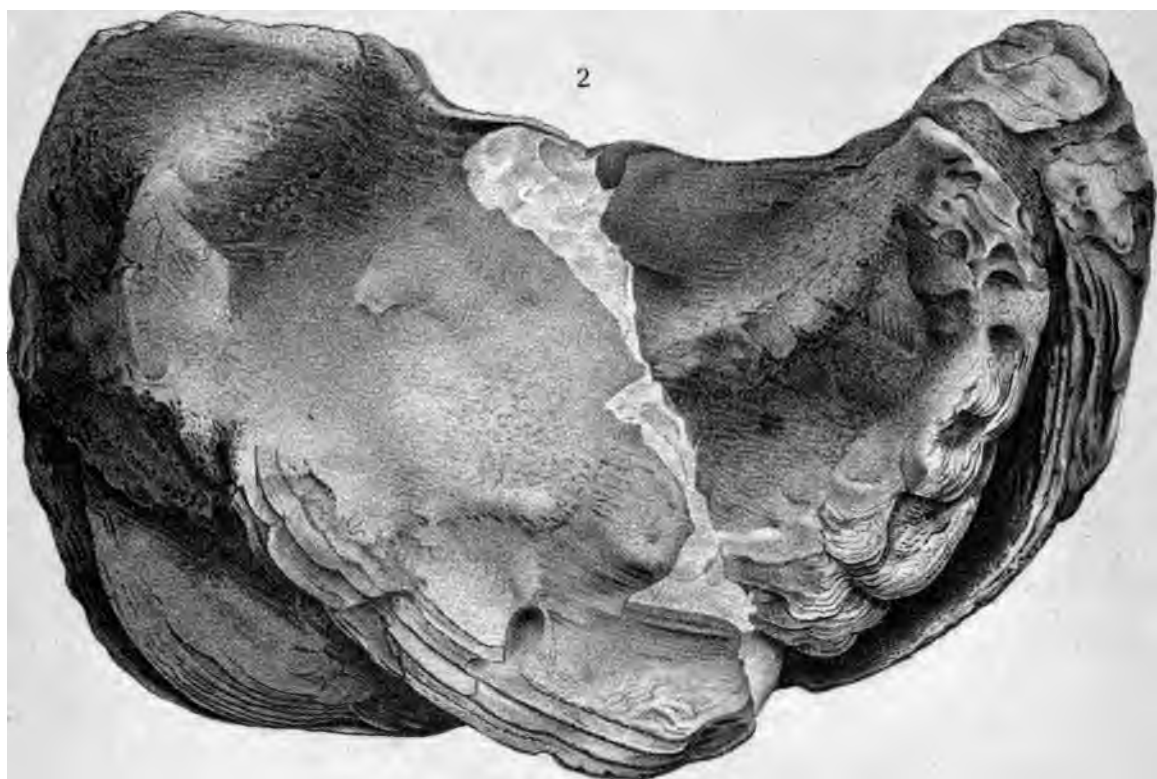
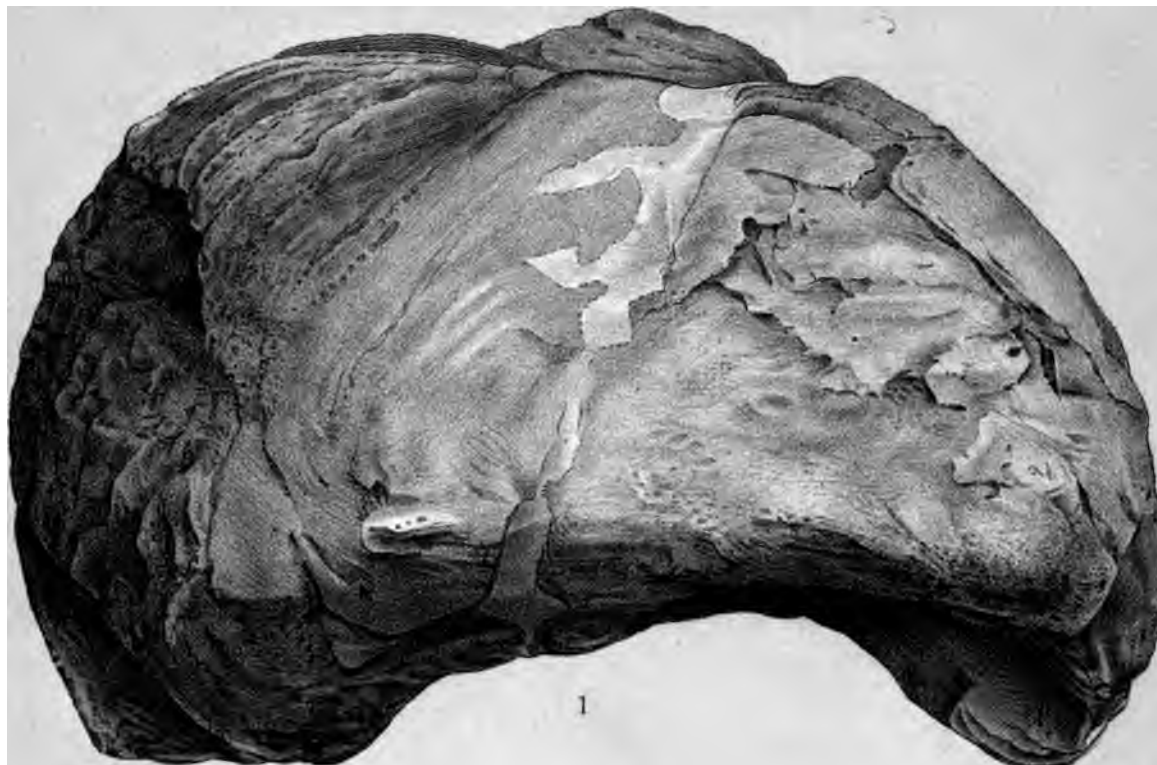
Werner & Winter Frankfort 9M, lith

CRETACEOUS INVERTEBRATES.

STANTON: THE MARINE CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE I.

OSTREA TARDENSIS Stanton	PAGE II
Fig. 1. Lower valve of an average specimen. Natural size.	
Fig. 2. Opposite view showing upper valve of same individual.	



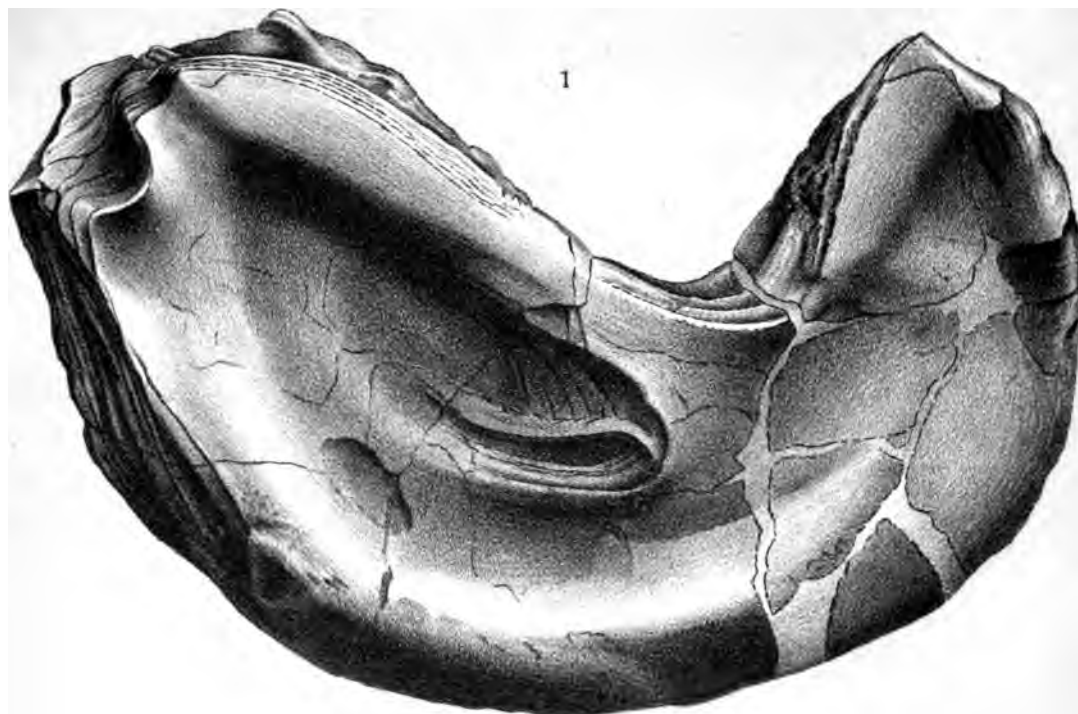
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Werner & Wirtz, Frankfurt a/M., lith.

CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE II.

OSTREA TARDENSIS Stanton	PAGE II
Fig. 1. Exterior of more strongly curved upper valve. Natural size.	
Fig. 2. Interior of same.	
NOTE.—This specimen was inadvertently posed with the beak downward.	



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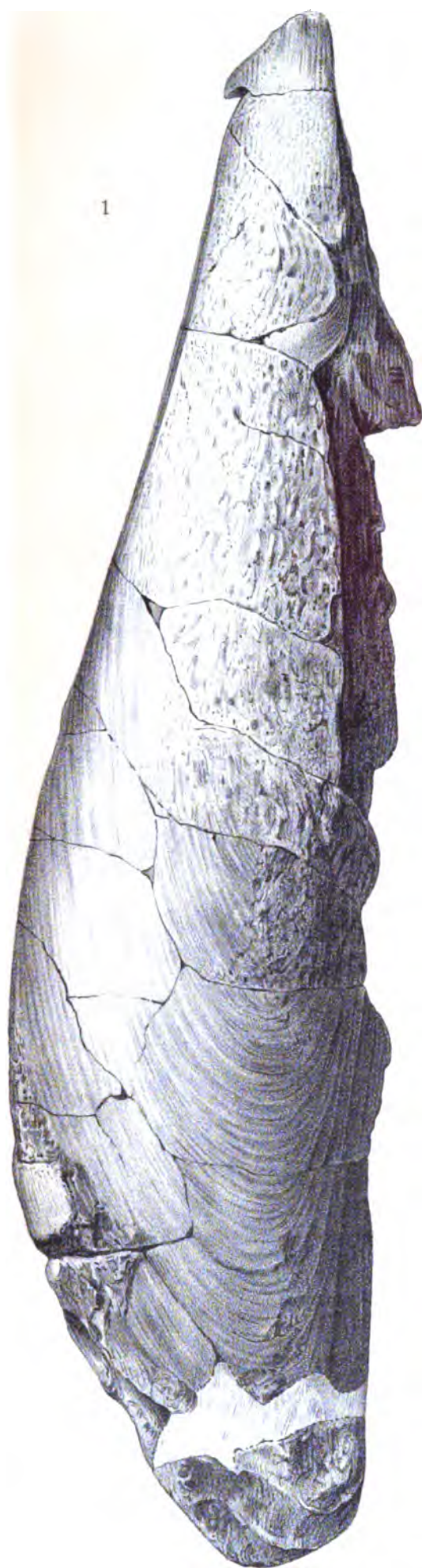
Werner & Winter Frankfort a/M. lith.

CRETACEOUS INVERTEBRATES.

STANTON: THE MARINE CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE III.

	PAGE
GERVILLIA HATCHERI Stanton	15
Figs. 1, 2. Exterior and interior views of the type. Natural size.	



M^c Connell del.

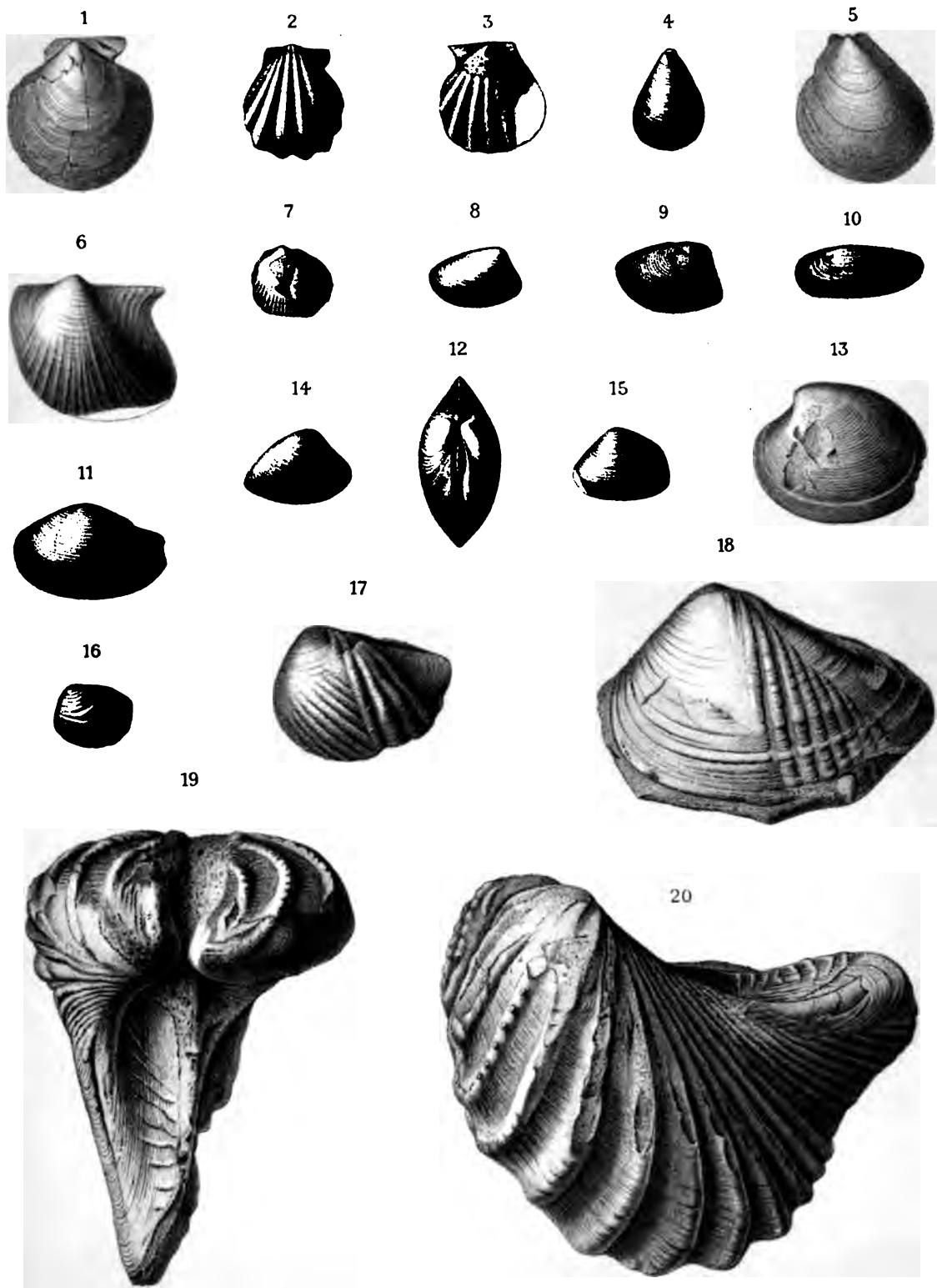


Werner & Winter Frankfort M. lith.

STANTON: THE MARINE CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE IV.

	PAGE
PECTEN (CAMPTONECTES) PUEYRRYDONENSIS Stanton	12
Fig. 1. Right valve. Natural size.	
PECTEN OCTOPLICATUS Stanton	14
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Fig. 3. Left valve, similarly enlarged.	
MYTILUS ARGENTINUS Stanton	16
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PECTEN ARGENTINUS Stanton	13
Fig. 5. Left valve. Natural size.	
AVICULA (OXYTOMA) TARDENSIS Stanton	14
Fig. 6. A small left valve enlarged three diameters to show details of sculpture. From a wax cast of a natural mold.	
Fig. 7. An average left valve, natural size, with most of the shell and posterior ear removed.	
NUCULA PUEYRRYDONENSIS Stanton	17
Fig. 8. A small left valve from a wax cast of a natural mold.	
Fig. 9. Another left valve.	
SOLECURTUS? LIMATUS Stanton	24
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LEDA? CORBULIFORMIS Stanton	18
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Fig. 12. Dorsal view of type, enlarged two diameters.	
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Fig. 16. Young specimen showing concentric sculpture of beak and beginning of posterior series of costæ.	
Fig. 17. Half-grown specimen showing further development of costæ.	
Fig. 18. Larger specimen with anterior sculpture obscured by weathering.	
TRIGONIA SUBVENTRICOSA Stanton	18
Fig. 19. Dorsal view of the type.	
Fig. 20. Left valve of same.	
All figures of natural size unless otherwise stated.	



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EXPLANATION OF PLATE V.

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ASTARTE PERALTA Stanton	22
Fig. 1. Hinge of right valve.	
Fig. 2. Exterior of same specimen.	
ASTARTE POSTSULCATA Stanton	23
Fig. 3. Interior of thin right valve.	
Fig. 4. Exterior of a similar valve.	
Fig. 5. Dorsal view of an example with thicker valves.	
Fig. 6. Hinge of a thick left valve.	
Fig. 7. Exterior of same specimen.	
All figures on this plate are of natural size.	

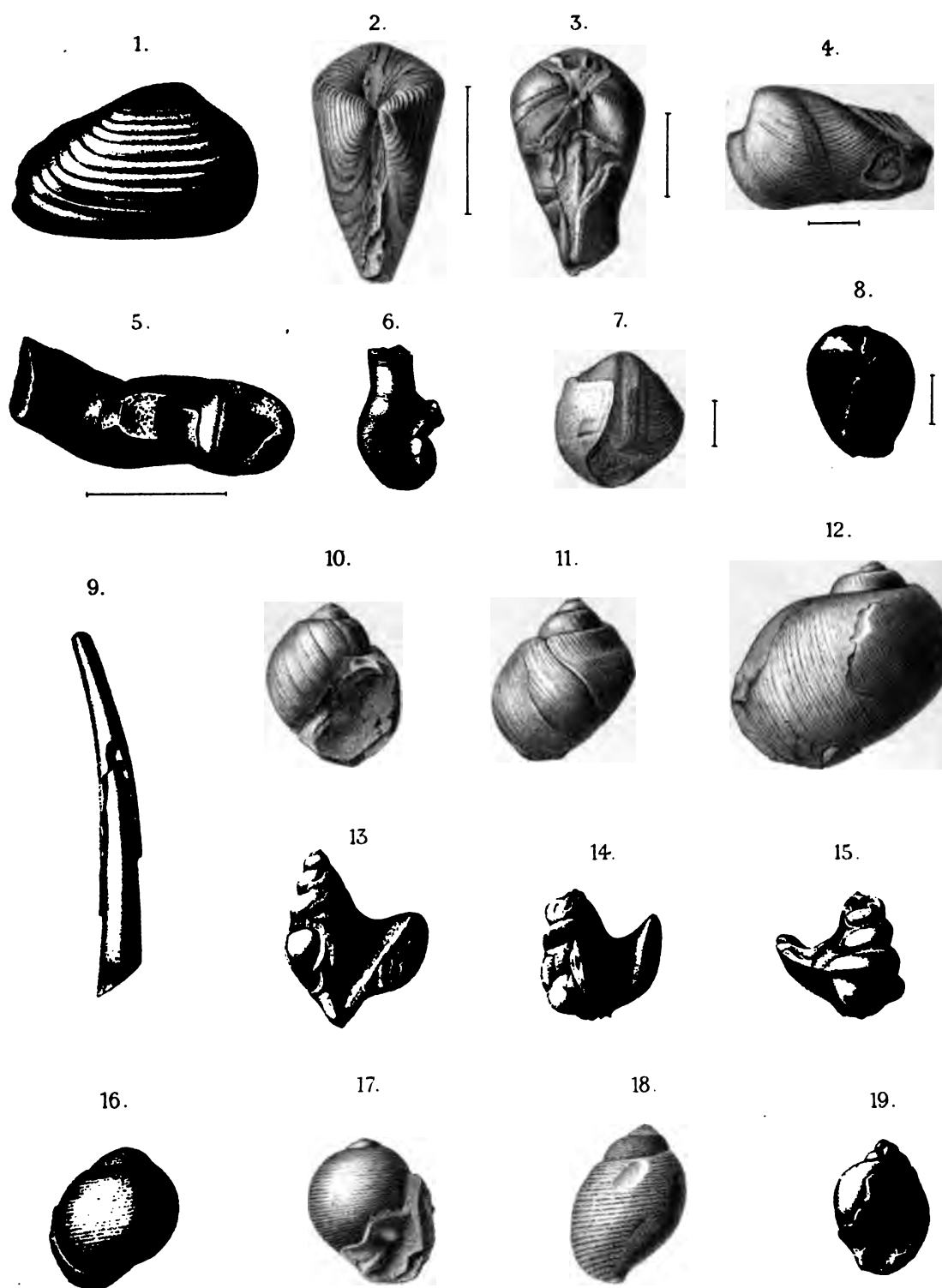


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EXPLANATION OF PLATE VI.

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PLEUROMYA LATUSULCATA Stanton	25
Fig. 1. Right valve of the type.	
Fig. 2. Dorsal view of same.	
MARTESIA ARGENTINENSIS Stanton	27
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Fig. 5. Part of a tube with shell in place, enlarged two diameters.	
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DENTALIUM (LÆVIDENTALIUM) LIMATUM Stanton	28
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LUNATIA CONSTRICTA Stanton	31
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APORRHAIUS PROTUBERATUS Stanton	32
Fig. 13. Aperture view of an average specimen with part of the shell and the callus of last whorl destroyed.	
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TORNATELLÆA PATAGONICA Stanton	34
Fig. 18. Dorsal view of one of the types, enlarged two diameters.	
Fig. 19. Aperture view of another specimen, enlarged two diameters.	
All figures are of natural size unless otherwise stated.	



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STANTON: THE MARINE CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE VII.

	PAGE
PLEUROTOMARIA TARDENSIS Stanton	29
Fig. 1. Aperture view of the type.	
Fig. 2. Profile view of same showing the slit.	
Both figures are natural size.	

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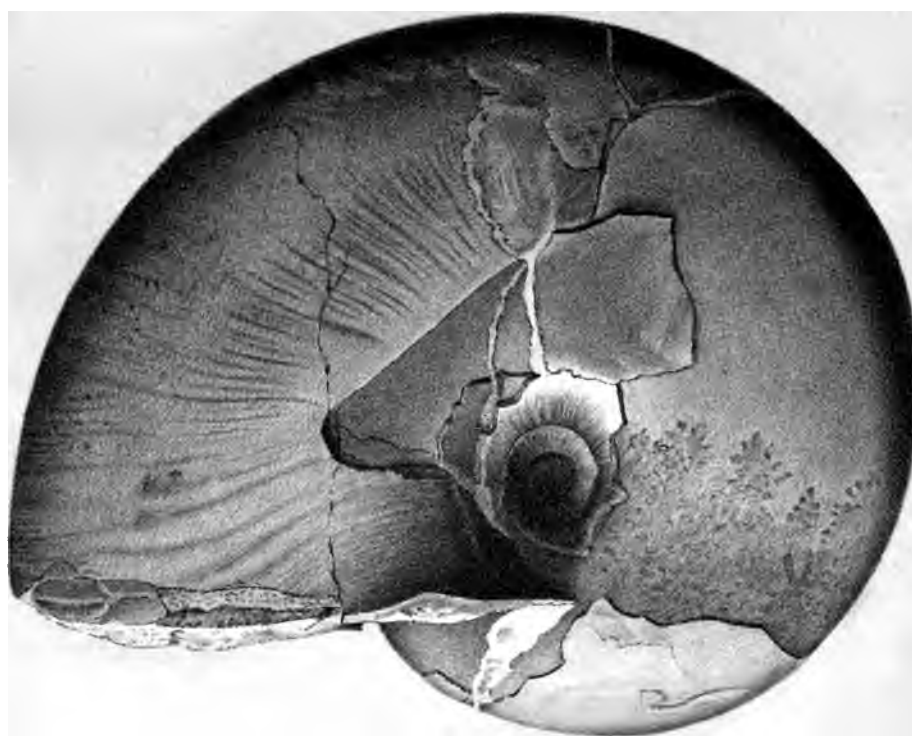
EXPLANATION OF PLATE VIII.

	PAGE
HATCHERICERAS PATAGONENSE Stanton	38
Fig. 1. Side view of type, one half natural size.	
Fig. 2. Aperture view of same, one half natural size.	

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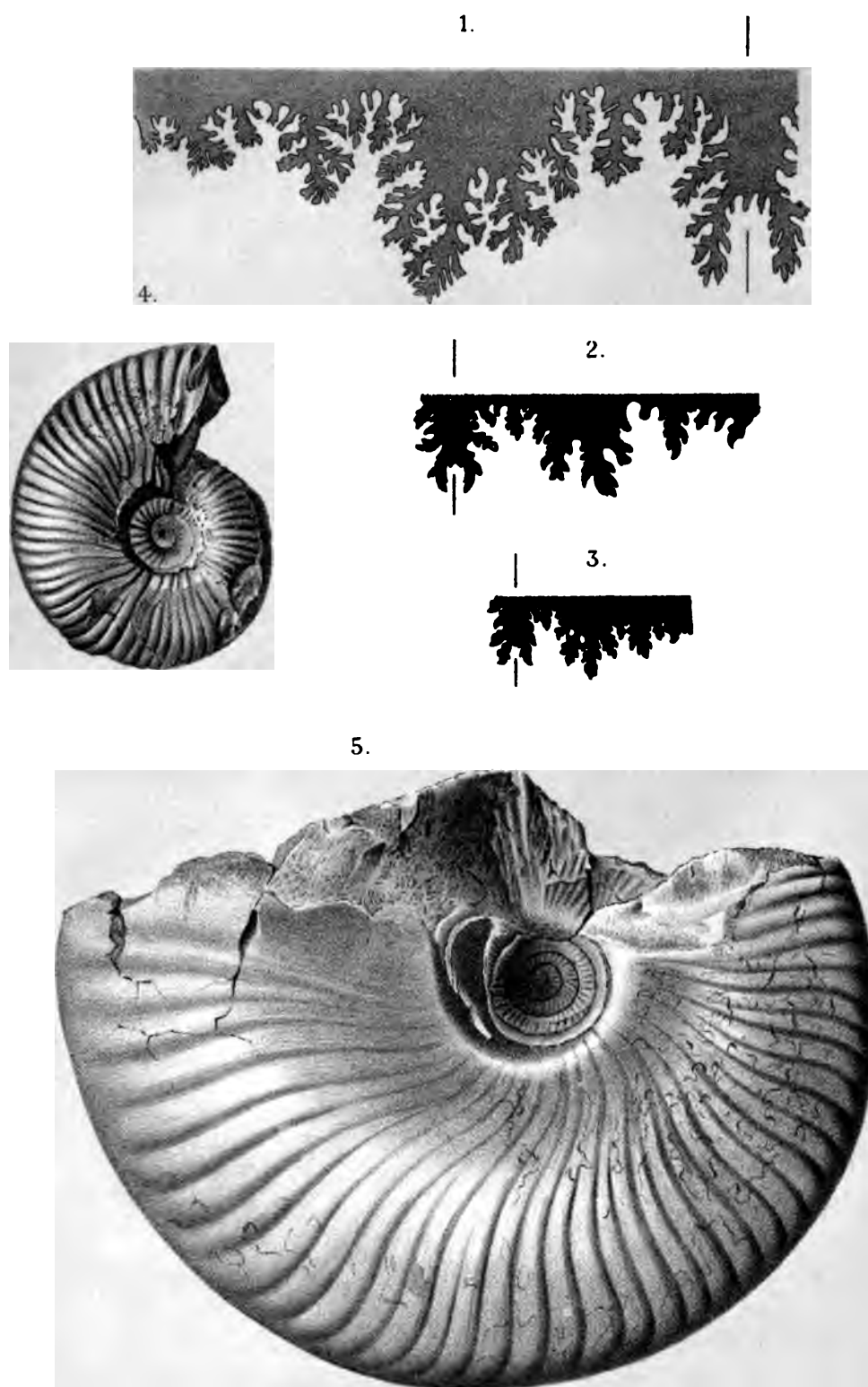
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CRETACEOUS INVERTEBRATES.

EXPLANATION OF PLATE IX.

	PAGE
HATCHERICERAS PATAGONENSE Stanton	38
Fig. 1. Suture of specimen figured on plate VIII.	
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EXPLANATION OF PLATE X.

	PAGE
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